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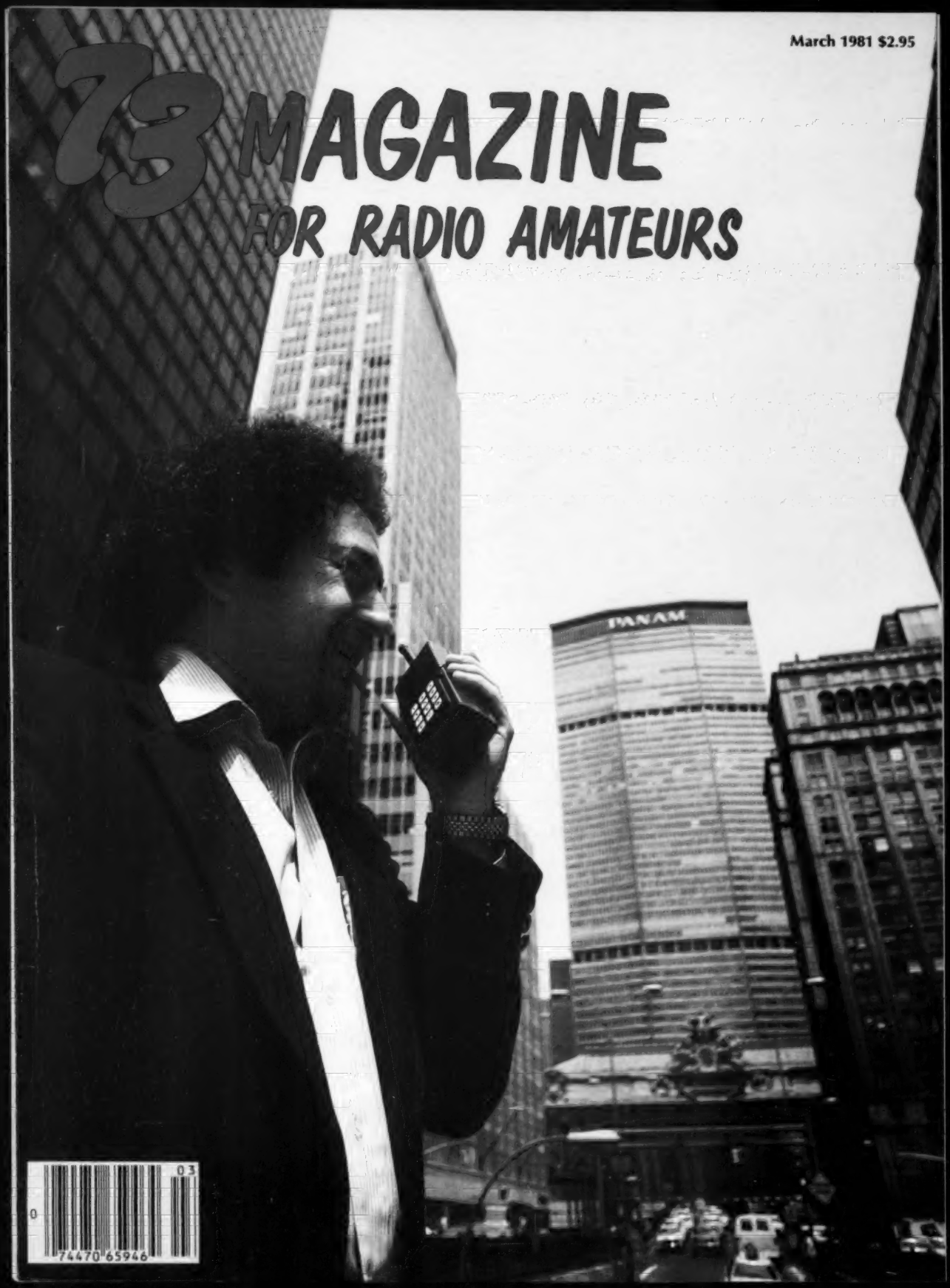
73 MAGAZINE
FOR RADIO AMATEURS



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W2NSD/1
NEVER SAY DIE

editorial by Wayne Green

BUY AMERICAN

The other day I met a chap who mentioned that *he* had bought an American car and thus was not supporting the Japanese. Some of our American ham manufacturers are waving a similar flag. As the user of Japanese ham rigs, Japanese cards, Japanese hi-fi, Japanese cameras, Japanese calculators, Japanese cassette players, etc., perhaps I can put this into some more realistic perspective.

Firstly, in case there is any red-neck reaction that I'm not a patriotic American, I would like to point out that I was right along there with everyone else in WWII. Secondly, having now visited nearly 100 different countries I am in a position to say with authority that I have yet to visit another country that I would prefer to the US. I am not in any way blind to the manifest faults of our country, it's just that even with them it is better than the others.

Those of you who have read my editorials know that I am not reticent about writing about things which I feel should be improved about our country. It is in that respect that I would like to comment upon the subject of imports. One of the great hopes that I have is that the Reagan administration will be able to curb the growing socialism which has weakened our country and that they will be able to stop the growth of government control of us all. There may indeed be ways that some of the more obvious agencies can be made to provide value to all of us, but until then I can only be distressed by HEW, OSHA, FTC, and some agencies which I don't even dare to name for fear of reprisal. They have unlimited funds to harass me and a history of using them for that purpose on others.

The United States could be competitive with other countries but for several problems. One is the tax situation. I've just recently opened a production plant in Ireland to put out Instant Software packages for sale in the European and Middle Eastern countries. If I want to buy a piece of production equipment in the US, I not only have to pay for it up front, I also have to buy it from profits. This means that in essence I have to pay double for it...less a small amount for an investment tax credit. If I want to put up the same machine in Ireland, I find that not only are there no requirements for using profits for this, but that the government is standing ready to put up about 50% of the cost of the equipment. Thus the bottom line to me is a cost of about four times as much to get the new equipment for production in the US as in Ireland.

Much has been written about the efficiencies of foreign production through their use of modern production equipment. This keeps cost down and makes a firm more competitive. Until such time as the tax situation here changes, I fear that the US can only fall further behind in production efficiency. Productivity, it is called.

In the car industry there are other problems. No doubt you've seen pictures of the automated Japanese car plants. Why don't we have those here? One reason is the high cost, where the machinery needed costs several times as much because of taxes and no government help. Another is the fierce resistance of the auto unions to anything which will cut down on the number of workers needed. That would be okay if all other countries would do the same. Unions, as a matter of course, bitterly fight automation. Add to that the wages achieved by our auto unions...double the average American wage...and you see why Detroit has no chance of being competitive with foreign firms.

Should we set up limitations on imports? This will bring on similar limitations on our products...and not so much on those which are not competitive as those which are. That is a losing battle and it takes a keen insensitivity to history to recommend limitations on imports.

Three years ago I foolishly went out and ordered an American car. I have lived to regret that impulse. It was a Dodge. The first thing that happened was that I was ripped off by the dealer for $200. I put down a payment with my order...and though the dealer was unable to provide the car, he still kept the $200. I complained to Chrysler and they said, in effect, tough. I did get the Dodge from another dealer when the first was unable to get it in a reasonable time. The car worked for a few weeks and then the engine stopped being dependable, stalling and being unstartable more often than not. The local Chrysler garage tried to fix this, coming up with many approaches. None has succeeded and it still goes through the process of starting up...running for a few minutes and then stopping. Oh, it *can* be started if you take the engine cover off (it's a van) and pour gas into the carburetor directly.

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A 49-MHz Repeater?
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TR-7400 Behind Bars
—something new in S-meters
..... WB3ATP 46

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Home-Brew X-Band Wavemeter
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Practical Af and Rf Speech Processing
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LOR: A Light-Operated Relay
—handy circuit has many uses
..... PY2AUC 76

The Calibrator Gater
—so you can find yourself... WB5PPV 78

COVER: Talk to the world through your 2-meter handie-talkie! Metroplex, the New York City metropolitan area's most sophisticated system of inter-linked repeaters, has over 400 members, including 50 overseas amateur radio operators!

Metroplex was conceived in January, 1978, by K2KLN and WB2MGB to: establish repeaters on *all* allocated FCC frequencies; use all available modes; provide 24-hour emergency communications; and provide a forum for east coast and worldwide amateur radio operators, via a 2-meter/10-meter FM link. Club members have already contacted over 35 countries on 4 continents through the 10-meter link.

Autopatch facilities are completely computerized and are part of a large long-distance network which includes trunk lines, satellites, and emergency speed-dial numbers. All frequencies are coordinated through T-SARC.

Listen to Metroplex FM on 29.640/29.540 in, and on 145.450/144.850, 223.720, and 443.950. For further information, write PO Box 237, Leonia NJ 07605, or call the 24-hour club phone, (201)-592-1579, to request an information package. (Photo of Hank Goldman WA2OVG by Larry Mulvehill WB2ZPI, Cold Spring NY.)

The Last PL Generator
—this synthesized unit is the last one you'll ever need..... WB2BWJ 50

An End to Repeater Time-Outs
—with the IC-211..... VP2EZ 53

The History of Ham Radio
—part XII..... W9CI 54

Half a Loaf
—charger for 6-volt batteries
..... Nordgren 60

The Great Aluminum Cover-Up
—how to paint the stuff..... WB0YTH 62

The Flexi-Plane Antenna
—this "scrawny ducky" will boost your HT's signal..... N1PL 80

CB to 10...and Beyond
—getting excited at 432..... WB3CDE 84

Three-Way Power Supply
—ideal for CMOS, TTL, op-amp projects..... W3HB 86

Home-Brew in the Real World
—victim tells all..... WB1GVU 87

DXing the Past
—a visit to Signal Hill..... VE3CXL 88

Never Say Die—4, Contests—10, RTTY Loop—18, Letters—20, Awards—22, Review—24, OSCAR Orbits—30, FCC—32, New Products—36, Ham Help—91, 97, 101, 106, Social Events—92, Fun!—104, Corrections—106, Dealer Directory—129, Propagation—129

Nothing else known to man will start it.

The purpose of the van was to provide a work area for me while I was traveling to club meetings and on business trips. The van bounces so badly that it is useless for this. The shocks rattle, the thing falls apart faster than a team of ours can put it back together. It is a disaster.

Compare that to the Mazda RX-7 which goes like spit, has caused virtually no problems, does not bounce or rattle, and gives us almost twice the gas mileage. It does not have quite the room of the van and seats two instead of ten, admittedly. It does not have room to mount a typewriter, but then what good is a typewriter if one can't hit the right keys because it is bouncing around so much? The Chrysler reaction to my problems has mainly been one of it being my fault for buying the car, not any serious effort to see what they can do to solve the problems.

Much has been written about the problem of productivity, but the basic reasons for it are still untouched. I think that American firms could compete with the Japanese if we had just two major changes. One would be a tax change which would encourage automation and modernization. The other change needed is some sort of enormous growth in the number of hams in America so we would again be competitive technologically.

When I bring up growth of amateur radio, I'm no longer thinking in terms of trying to get back to the 11% growth we had before Incentive Licensing was proposed in 1963, when we went to a negative growth. We're over one million technicians and engineers behind where we should be and we desperately need to play catch-up.

The future is electronic, whether you are looking at computer, entertainment, communications, or automation. We're heading into an era of satellite communications which will reach right down to every office and home. We're looking at more and more of our home and office equipment going electronic. Just a few weeks ago I saw the prototype of a microprocessor controlled ski binding. We're going to have to adjust to electronics playing an important role in our life over the next twenty years and that means that we must have the engineers and technicians to design, build, install, operate, and service all of this stuff.

In that light we don't need a 10% growth, we need a 50% to 100% ham growth for a few years. Whether this is something which can be done under the present regulations or not, I don't know. It may be that Radio Shack can help. It may be that an aggressive approach by ham clubs, invading our high schools, will do the job. We may need every attack we can think of... but somehow we must get growth of amateur radio if we don't want to see our industries fall further and further behind.

250,000 NEW HAMS?

The fantastic success Tufts Electronics has had in getting new hams licensed gave me an idea. First, let me explain that Tufts took a back part of the store and set up an area where Novice classes could be held. The classes have been gaining in popularity and the graduation of about 90% into licensed hams has been experienced.

One minor note. Tufts contacted the League for help in getting an outside ham to come in and give the Novice license exams. The chap they recommended was contacted and my understanding is that he refused to give the exams except for $5 each... however, for that price he guaranteed that everyone would pass... presumably even if he had to help them do the test.

At any rate, the idea that came to me one morning was to try to interest Radio Shack in setting up ham classes in all of their 5,000 company-owned stores. If they were to set up to handle ten to twenty people, it would not take a lot of room, and would have a large number of benefits to Radio Shack... and obviously to amateur radio, too.

If these stores only provided 50 Novices per year, this would be a total of 250,000 new hams per year. At that rate we might catch up with Japan in engineers and technicians within five years and have a chance at getting back the technological ball in electronics.

The plan would be for the classes to run for ten weeks, with class time spent mostly in teaching the students the theory they will need for the Novice ticket and as a foundation for the General ticket later on. They would also be taught the rules and regulations, plus all sorts of background about amateur radio which they will need as amateurs. The teaching would be largely by way of video tapes which I would provide. I'm set up to make tapes now and have the experience of our audio cassettes on Novice exams.

Well... I Can Dream, Can't I? **by Bandel Linn K4PP**

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TR-2400 FEATURES:

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  Single or fast continuous 5-kHz steps from 143.900 to 148.495 MHz for Amateur and MARS or CAP simplex or repeater operation.
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  Uses all 16 buttons of keyboard while transmitting.

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  Checks all 10 memory channels. Programmable to lock automatically on either BUSY (signal present) or OPEN (no signal) channels.
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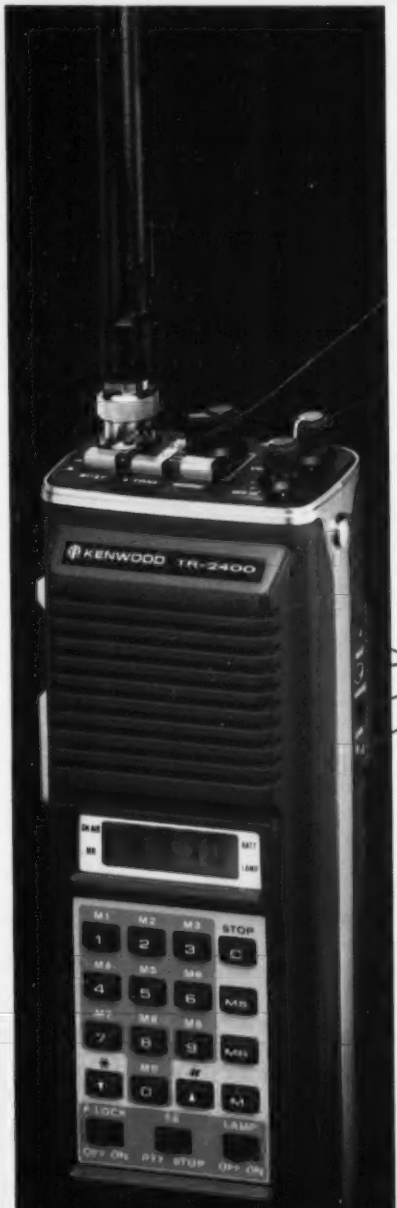
  Activates subaudible tone encoder (not Kenwood-supplied).



- **Repeater or simplex operation**
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  Only 2-13/16 inches wide, 7-9/16 inches high, and 1-7/8 inches deep. Weighs only 1.62 pounds (including antenna, battery, and hand strap).

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- ST-1 base stand (shown) which provides 1.5-hour quick charge, 4-pin connector for dynamic microphone, and SO-239 antenna connector.
- BC-5 DC quick charger (1.5 to 2.0 hours)
- SMC-24 speaker/microphone
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- PB-24 extra battery pack with charger adapter
- BH-1 belt hook

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The Morse code would be taught mostly via audio cassettes...and we *do* have the best series for that yet produced by anyone. The study manual would also be available from *73* ...one of the few study manuals which stresses understanding the basics instead of just memorizing questions and answers.

New hams need to have some background in how to operate, how to tune a rig, what swr is and how to use an swr meter, etc. They should know about DX and how to work it...understand about contests and the many other phases of amateur radio such as RTTY, SSTV, FAX, microwaves, repeaters, and so on. These are a natural for video tape. This would make the courses both interesting and informative, providing constant lifts of enthusiasm for the hopefuls. It can get very discouraging at times, so one has to remember that these classes *are* show business.

The exams and help with questions could be provided by nearby ham clubs.

The course should not be given free since that encourages people to drop out when some conflict makes them miss one class. I suggest a charge of $50 to cover the costs of the space, the code tapes, the study manual, a code practice key and buzzer, and the use of the video tapes. This would bring in at least $12.5M for Radio Shack at the 250,000 Novice level.

A side benefit to Radio Shack would be the generation of a bunch of new customers who are used to coming to their stores. If they put out a Novice rig at, say, $350, they would be able to generate another $85M or so in sales, bringing the whole project up to around $100M.

As long as the computer sales don't falter in their growth, Tandy will continue to have a healthy stock price. But perhaps, in view of the softness of the product through their lack of adequate software and with the impending invasion from Japan, it might just be prudent for Tandy to have a new project in the wings which can keep profits growing in case the computer line falters.

Radio Shack has tried several other fields for possible development into major consumer sales, but they have fallen through. Perhaps ham radio is one which would click. Between the ham clubs and local advertising and promotion to get in high school students, I think that 250,000 per year is not a difficult goal for such a program. That would only require one evening per week for the stores. Two evenings a week, average, would bring out 500,000 new hams a year. We might have to get real busy and develop some of the plans for coping with that number of hams if that came about.

Despite the seeming crowds on our ham bands today, the technical developments we see immediately ahead would enable us to cope with at least ten times as many hams as we have right now. It would be one of the best things to ever happen to amateur radio.

The classes would help to focus the attention of our country on the need for amateurs as a way to regain our lead in electronic technology...making ham radio and Radio Shack the heros. Perhaps in five to ten years the damage done by "Incentive Licensing" can be undone.

VIVA ARRL

Every now and then I meet a ham who really believes that I am anti-League. Gracious, nothing could be further from the truth! I have long been a steadfast and loyal supporter of this organization which is devoted to the relaying of messages by amateur radio. Indeed, where would our country be without this free message service?

Oh, I must admit to a bit of pique when some of the ideas which I have suggested to the League have been given short shrift. But these ideas were only for the purpose of improving their image and bringing more glory to amateur radio. For instance, I can only ascribe the refusal to institute the Singing Hamgram to the classical Not-Invented-Here mentality.

It stands to reason that if amateur radio relaying is ever going to be successful it is going to have to take cognizance of the competition and meet it with similar or better services. Older-timers will remember the triumphs of the past. What old-time ARRL member isn't moved to tears over the memory of the Postal Telegraph being forced out of business? I've got my 40-year membership pin and I'm pulling for us to topple Western Union. We've got 'em on the ropes, but we must keep up the pressure.

As an answer to those mentally retarded illiterates who insist that I am not 100% pro-ARRL, I pledge to find something positive to say about the organization. After looking over the situation carefully, I believe that I will be able to come up with a very positive statement along in June or July. This will take some research on my part, but it will be worth every minute of it if I can counter the calumny which has been spread by people who are trying to hurt *73 Magazine*.

AFRICAN POWER

While it sure would be nice to both perk up the action in the African countries with more hamming and to know that amateur radio is doing its thing for these countries by providing them with a reservoir of young hams who can then go on to being engineers and technicians ...much as was done in Jordan, there are some special problems facing most African countries which have to be taken into consideration.

It is a fact that most African countries are paying heavily for their technical work to be done. They have to import European engineers and technicians at substantially higher salaries than would have to be paid for citizens. In many cases, where the country goes to the expense of sending its own citizens to the US or Europe for technical training, these people remain abroad since their opportunities are far better there than at home.

Amateur radio could solve a lot of that problem for these countries, if it were given a chance. The country would have to support the establishment of ham stations and ham study groups within their youth clubs. They would have, as did Jordan, to set up some people to make the rounds of these clubs and provide the technical training needed.

My friends in these countries assure me that there are teenagers in these countries with brains and the drive to go far in electronics, if only a ham program could be instituted. There is no shortage of the raw materi-

Continued on page 102

2A Versatility

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ICOM

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

ARRL INTERNATIONAL DX CONTEST—PHONE

0000 GMT March 7 to 2400 GMT March 8

The ARRL-sponsored contest is open to all amateurs worldwide. Note that the basic contest format has been returned to that of 1979, with W/VE stations working the world and everybody else working W/VE stations only. The changes to single-band categories and the expanded awards program proved very popular and remain unchanged. Use all bands, 1.8 to 30 MHz.

Operating categories include single operator allband and single-band; multi-operator single transmitter or multi-transmitter; QRP single transmitter only with 10 Watts input or less (5 Watts output or less).

Your callsign must indicate your DXCC country (KL7XYZ/2 in NJ, FG0AAA/FS on St. Martin, etc.). One operator may not use more than one callsign from any given location during the contest period. The same station may be worked only once per band. No crossmode, crossband, or repeater contacts. Aeronautical and maritime mobile stations outside the USA and Canada may be worked for QSO credit only by W/VE stations. All transmitters and receivers must be located within a 500-meter-diameter circle, excluding directly-connected antennas. This prohibits the use of remote receiving installations. However, multi-operator stations may use spotting nets for multiplier hunting only.

EXCHANGE

W/VE stations (includes 48 contiguous United States and does not include Canadian islands of St. Paul and Sable) send RS and state/province. DX stations send RS and transmitting power as a 3-digit number.

SCORING

W/VE stations count 3 points per DX QSO. The multiplier is the sum of DXCC countries (except US and Canada) worked per band. DX stations score 3 points per W/VE QSO. The multiplier is the US states (except KL7 and KH6) and VE1-7, VO, and VE8/VY1 worked per band. Maximum of 57 per band. Final score is total QSO points times the total multiplier.

AWARDS

Various plaques and certificates to top scorers. Certificates to each DX entrant making more than 500 QSOs. ARRL-affiliated clubs compete for gavels on three levels: unlimited, medium, and local clubs. Details should have appeared in the January, 1981, *QST*.

ENTRIES:

All entrants are encouraged to use forms available from ARRL (include an SASE or one IRC). Logs should indicate times in GMT, bands, calls, and exchanges. Multipliers should be clearly marked in the log the first time worked. Entries with more than 500 QSOs must include cross-check sheets. All operators of multi-operator stations must be listed. Entries must be postmarked by April 7, 1981, and addressed to ARRL, 225 Main Street, Newington CT 06111. Any entries received after mid-July may not make *QST* listings. Usual entry conditions and disqualification criteria.

BOY SCOUT EXHIBITION STATION

The Playground Amateur Radio Club (PARC) of Fort Walton Beach, Florida, will operate a special event station at the 1981 Boy Scouts of America Choctawhatchee District Scout Exhibition. PARC members will operate station WB4SFU (Scouts For Unity) from 0000 to 2400 GMT on March 14, 1981. The station will be operating on 14290, 21370, and 28600 kHz on SSB. A special commemorative QSL card will be sent to those who QSL with an SASE. The QSL manager is PARC, c/o Joe Giangrosso WD4JZG, PO Box 3075, Fort Walton Beach FL 32548.

QCWA QSO PARTY—PHONE

0001 GMT March 14 to 2400 GMT March 15

Contacts with the same station on more than one band can be scored only once. Contacts made with "captive" stations, such as when operating in local nets, are not valid.

EXCHANGE:

QSO number, operator's name, and QCWA chapter identification (official number or name). Members not affiliated with a chapter should use "AL." If a member belongs to several chapters, then *one* must be chosen and used for the QSO Party. If desired, you may use one chapter for the CW Party and another one that you belong to for the Phone Party.

FREQUENCIES:

Any authorized amateur frequency is permissible. The following suggested frequencies have been selected to minimize interference to others:

3900-3930, 7230-7260, 14280-14310, 21350-21380, 28600-28630.

SCORING:

Each contact made with another QCWA member will count as a single point. Add up the contacts with QCWA members and then multiply this number by the number of chapters represented.

AWARDS:

Plaques for the top scorers; certificates will be given for the 2nd through 5th runners up. Standings and scores will be published in the *QCWA NEWS*, summer, 1981, issue.

ENTRIES:

Logs should include the following information: time (GMT), call, QSO numbers, name, chapter number or name, state or country. It is the responsibility of each contestant to provide a legible log (no carbon copies) and to list all claimed contacts. The total contacts for each page will be recorded at the bottom of each page. The total contacts for the Party should be recorded

CALENDAR

Mar 7-8	1981 SSTV Contest
Mar 7-8	ARRL DX Contest—Phone
Mar 14	Boy Scout Exhibition Station
Mar 14	DARC Corona 10-meter RTTY Contest
Mar 14-15	QCWA QSO Party—Phone
Mar 14-15	ERAA QSO Party
Mar 14-15	South Carolina QSO Party
Mar 21-22	Bermuda Contest
Mar 21-22	CARF Phone Commonwealth Contest
Mar 21-22	Tennessee QSO Party
Mar 21-23	BARTG Spring RTTY Contest
Mar 28-29	Spring VHF QSO Party
Mar 28-29	CQ World Wide WPX—SSB
Mar 28-29	YL ISSB QSO Party—CW
Mar 28-29	NA/SA RTTY Flash
Apr 18-19	YL ISSB QSO Party—Phone
Apr 18-20	QRP QSO Party
Apr 25-26	Helvetia Contest
May 10	DARC Corona 10-Meter RTTY Contest
May 23-24	Europe and Africa Giant RTTY Flash
Aug 8-9	European DX Contest—CW
Sep 12-13	European DX Contest—Phone
Sep 12-13	G-QRP-Club CW Activity Weekend
Sep 12-14	Washington State QSO Party
Sep 26	DARC Corona 10-Meter RTTY Contest
Nov 8	DARC Corona 10-Meter RTTY Contest
Nov 14-15	European DX Contest—RTTY
Dec 26-31	G-QRP-Club Winter Sports

A superb frequency counter is frequently not counted-just because it doesn't have a high price-tag.

The truth is, our 8000B 1 Gigahertz is an excellent counter. In fact, it's preferred by many engineers, technicians, and electronic enthusiasts. Not a single competitor on the market today can surpass our price/performance ratio.

And we've deliberately kept our prices down. First, we've refused to join everybody else in their high mark ups. Instead of "charge what the market will bear," for us it's "charge a fair price." Second, we sell what we manufacture, directly to you. So extra costs of extra steps are automatically eliminated. Third, we have to build a lot of frequency counters to meet the demand. Because we do sell so many, we don't have to charge a high price to make a profit.

And about quality . . . Sabtronics frequency counters always have the most innovative features available. For example, our 8000B 1 Gigahertz Frequency Counter has a 10 Megahertz precision crystal timebase. But most important, the 8000B, using the most advanced LSI circuitry, has a guaranteed sensitivity of 30 millivolts up to 1 Gigahertz, with 20 millivolts typical. The three-stage differential amplifier IC makes this possible. Altogether, the 8000B uses only 6 IC's, making the chance of failure virtually nonexistent.

Three selectable gate times provide the measurement speed you need — and greater resolution. The resolution is further enhanced by our counter's 9-digit display.

Like the 8000B, Sabtronics' 8610B is a high-quality precision frequency counter. It features only 4 IC's, and offers a frequency range up to 600 Megahertz.

The cases of both counters are high strength impact-resistant ABS plastic. Elegant but very rugged. Sabtronics doesn't believe in skimping on the high quality construction that brings excellent performance. But we're not about to charge a high price just because we could get it!

Send in the coupon and order your new frequency counter now. Credit card holders may call.

BRIEF SPECIFICATIONS: **Frequency Range:** 10 Hz to 1 GHz (Model 8000B), 10 Hz to 600 MHz (Model 8610B); **Timebase:** Frequency: 10 MHz, Stability: ± 1 ppm (20 to 40C°.), Aging Rate: < 1 ppm/year; **Sensitivity** (adjustable): Input A< 15 mV to 100 MHz, Input B < 30 mV, 100 MHz to 1 GHz (Model 8000B), < 30 mV, 100 MHz to 600 MHz (Model 8610B); **Gate Times:** .1 sec., 1 sec., 10 sec.; **Resolution:** 0.1 Hz to 10MHz, 1 Hz to 100 MHz, 10 Hz to 1 GHz; **Display:** 9-digit LED 0.4"; **Power Requirements:** 4.5 to 6.5 VDC (4 C-cells) or optional AC adapter; **Dimensions:** 8" wide X 6.5" deep X 3" high (203 X 165 X 76 mm), 1.3 pounds (590 g) excluding battery.

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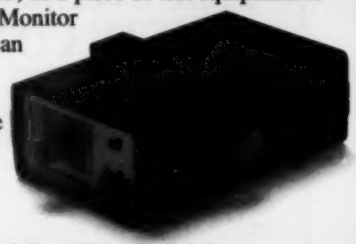

- All tones in Group A and Group B are included.
- Output level flat to within 1.5db over entire range selected.
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77.0 XB	100.0 1Z	131.8 3B	173.8 6A
79.7 SP	103.5 1A	136.5 4Z	179.9 6B
82.5 YZ	107.2 1B	141.3 4A	186.2 7Z
85.4 YA	110.9 2Z	146.2 4B	192.8 7A
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- Frequency accuracy, ± .1 Hz maximum - 40°C to + 85°C
- Frequencies to 250 Hz available on special order
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at the top-right of the first page of the log. Log sheets will not be returned. Make sure you have correct postage when you mail your logs. Send logs no later than March 31, 1981, to: Pelican Chapter QCWA, Arthur M. Monsees W4BK, 1407 48th Avenue NE, St. Petersburg FL 33703. Separate logs and scores must be submitted for both the CW and Phone Parties. The decision of the Pelican Chapter of QCWA will be final with respect to scores and rules. In the event of errors or a disagreement, keep all details off the air and write either the Pelican Chapter or QCWA Headquarters.

Work as many QCWA members as possible and apply for the several Special QCWA Certificates which you have qualified for in the QCWA Parties: Worked 50 States, Worked 60 Chapters, Worked 100 Members, and Worked 500 Members.

1981 INTERNATIONAL SSTV CONTEST

Saturday, March 7, 1500 to 2300 GMT
Sunday, March 8, 1500 to 2400 GMT

SPONSOR — *73 Magazine*, Peterborough NH 03458 USA

OBJECT — To exchange SSTV pictures with as many stations in as many parts of the world as possible during the contest periods.

FREQUENCIES — All amateur frequencies between 3.5 and 29.7 MHz where SSTV is permitted.

EXCHANGE — Exchange of pictures must include callsign, RST report, and consecutive contact number starting with 001. FCC rules require a verbal exchange of callsigns for US stations. Do not include the contact number in the verbal exchange.

CREDITS — One (1) point for each station worked. A station may be worked once on each band for credit. One (1) point for each US state or Canadian province worked. Five (5) points for each country worked. Five (5) points for each continent worked. Each state, province, country, and continent may be counted only once for credit. Total score is the sum of all credits.

ENTRIES — Activity sheets should show station worked, state or province, country, continent, and band (80, 40, 20, 15, 10). Summary sheets should show number of stations worked, number of states and provinces worked, number of countries worked, number of continents worked, and total score. Entries become the property of the contest committee. Excessive discrepancies in a contest entry may cause disqualification. Contest entries must be postmarked no later than April 30, 1981. The decisions of the contest committee are final.

AWARDS — The top scorer will receive a certificate and a one year subscription to *73 Magazine*. Certificates will also be awarded to the station working the most countries and to the station working the most continents.

Send all entries to:
R. Brooks Kendall W1JKF
10 Stocker St.
Saugus MA 01906

or David Ingram K4TWJ
Eastwood Village, #1201 South
Rte. 11, Box 499
Birmingham AL 35210

DARC CORONA 10-METER RTTY CONTEST

1100 to 1700 GMT March 14

This is the first of four tests during the year sponsored by the DARC eV to promote RTTY activity on the 10-meter band. Each of the four tests is scored separately. Use the recommended portions of the 10-meter band.

EXCHANGE:

RST, QSO number, and name.

SCORING:

Each station can be contacted only once. Each completed two-way RTTY QSO is worth 1 point. Multipliers include the WAE and DXCC lists and each district in W/K, VE/VO, and VK. The final score is the total number of QSOs times the total multiplier.

AWARDS:

Plaques will be awarded to the leading stations in each class with a reasonable score present. Operating classes include: (1) class-A for single or multi-op and (2) class-B for SWLs.

ENTRIES:

Logs must contain name, call, and full address of participant. Also show class, times in GMT, exchange, and final score. SWLs apply to the rules accordingly. Logs must be received within 30 days after each test. Send all entries to: Klaus K. Zielski DF7FB, PO Box 1147, D-6455 Erlensee, West Germany.

The other contest periods are on May 10, September 26, and November 8, 1981.

SOUTH CAROLINA QSO PARTY

1700 GMT March 14 to 0500 GMT March 15
1500 to 2400 GMT March 15

The QSO party is again sponsored by the Colleton County Contestors. The same station may be worked on each band and mode. SC stations may work other in-state stations. Novice and Technician stations must sign /N or /T for identification purposes.

EXCHANGE:

RS(T) and state, province, country, or SC county.

SCORING:

SC stations score two points per QSO; SC Novice and Technicians score five points per QSO. Multiply QSO points by the number of SC counties + states + provinces + countries. All others score two points for each SC contact, five points if with a Novice or Technician in SC. Multiply total QSO points by the number of SC counties worked (46 max.).

FREQUENCIES:

PHONE—3900, 7260, 14300, 21360, 28600, 50.110, 144.2 (simplex—no repeaters!).

CW—1810, 3550, 3710, 7050, 7110, 14050, 21050, 21110, 28050, 28110.

AWARDS:

Certificates to top-scoring station in each SC county, state, province, and DX country. Also to top-scoring Novice and Technician in each SC county and each state.

ENTRIES:

Include a summary sheet with your entry showing scoring and other information. Mailing deadline is April 18, 1981, to: Colleton County Contestors, c/o Elliott Farrell, Jr. WA4YUU, PO Box 994, Walterboro SC 29488. Include a large SASE for a copy of the results.

ERAA QSO PARTY

1400 GMT March 14 to 0200 GMT March 15

The Edison Radio Amateurs' Association (ERAA) WA8SVA of southeastern Michigan will host a QSO party to commemorate ERRA's 40th anniversary. Those wishing to participate should exchange signal report and state with the ERAA QSO Party group. Phone operation only; suggested frequencies are 3930, 7240, 14300, 21400, 28800, 146.52 simplex, and 144.73/145.33 (ERRA repeater). The ERAA QSO Party group will be operating from Thomas Edison's first power station, Station A, in historic Greenfield Village, Dearborn, Michigan. QSL via WA8SVA, 12806 Royal Grand, Detroit MI 48239. Participants will receive a certificate by enclosing a business-sized SASE.

Continued on page 98

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- Powerful text editing facilities.
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- Excellent string handling capability—up to 26 string variables of any length.
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Built-In Notch Filter and Noise Blanker. Notch is variable from 200 Hz to 3.5 kHz with a depth of more than 50 dB. New noise blanker reduces ignition and line noise. Both standard equipment.

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Super Specs. *Optimized sensitivity*—a balance between dynamic range and sensitivity (2 μV on 160 to 0.3 μV on 10 meters) *Greater dynamic range*... better than 90 dB. And a PIN diode switchable 18 dB attenuator. *200 watts input on all* bands! *100% duty cycle* on *all* bands for up to 20 minutes.

Super Convenient. *Built-In VOX* with 3 up-front controls. *Built-In PTT* control at front and rear jacks. *Built-In Zero-Beat* switch puts you on exact frequency. *Built-In Adjustable Sidetone* with variable pitch and level. *Adjustable ALC* for full control from low power to full output. *2-Speed Break-In*, fast or slow speeds to fit operating conditions. *Built-In Speaker* eliminates desk clutter. *Automatic Sideband Selection*—reversible.

Super Design. *All Solid-State and Broadbanded*—from the pioneer, Ten-Tec. *Modular* plug-in circuit boards. *Functional Styling* with convenient controls, full shielding, easy-to-use size (5¾"h x 14¼"w x 14"d).

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Amateur Radio's first full break-in solid-state kW linear amplifier. With the reliability you'd expect from the pioneer in high-power solid-state technology—TEN-TEC.

All Solid-State. No tubes. Instead, HERCULES uses two 500-watt push-pull solid-state amplifier modules with an output combiner. Super solid.

Broadband Design. No knobs, no tuning. From the pioneer, TEN-TEC. For fast, effortless changing of bands. Super easy.

Automatic Bandswitching when used with OMNI (the OMNI bandswitch also controls HERCULES bandswitching through a motor driven stepping switch). Super convenient.

Full Break-In. HERCULES puts the conversation back into high power CW operation—you can hear between every character you send.

Full Coverage. 160 through 15 meters plus four "AUX" positions for 10-meter conversion by owner and future band additions.

Full Gallon. 1000 watts input on *all* bands, 600 watts output, typical. Built-in forced-air cooling. Driving power: 50 watts, typical. Adjustable negative ALC voltage. 100% duty cycle for SSB voice modulation; 50% duty cycle for CW/RTTY (keydown time: 5 minutes max.) Continuous carrier operation at reduced output.

Full Protection. *Six LED status indicators* continuously monitor operating conditions and shut down the amplifier whenever any one exceeds set limits (the exciter automatically bypasses the amplifier under amplifier shut-down for barefoot operation). The six parameters monitored are: 1) overdrive; 2) improper control switch setting; 3) heat sink temp.; 4) SWR; 5) overvoltage/overcurrent; 6) rf output balance. *Two meters* monitor collector current, voltage, and forward/reverse power. And a highly efficient *automatic line voltage correction* circuit (patent applied for) eliminates the need for selecting transformer taps, prevents applying too high a voltage to final amplifier devices, becomes operative under low line conditions.

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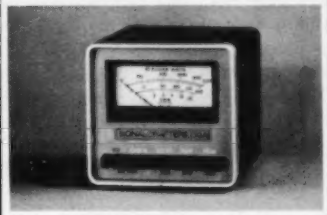

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RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
4006 Winlee Road
Randallstown MD 21133

Last month we took a look at the Microlog ATR-6800, one of the new breed of RTTY stations. This month shall be an examination of what it takes to put a unit like this on the air, and what operation itself is like.

To begin with, let me take a moment to describe the situation in the station when the ATR-6800 arrived. The station here is nothing fancy, consisting of basic equipment which may be found at many a ham's shack (see Fig. 1). The transmitter is a Heathkit® SB-401, with an SB-303 receiver. A SB-650 digital display makes readout of the receive frequency easy, although when in the RTTY mode the display is offset by the BFO frequency, in the 3-kHz range—makes things tough! Incoming RTTY signals are demodulated by a HAL ST-6, and normal printing is on an old Teletype® Model 15. Paper-tape equipment is in the loop, but not used too much. Keying of the transmitter is by the circuit described some time ago in *73*, off a magnetic reed relay in the loop.

In the interests of modernization, I will add that a 6800-based computer resides in the shack. By cabinet it is an SWTPC, but the guts are an amalgam of SWTPC, Smoke Signal Broadcasting, GIMIX, and Leavey Labs. A versatile RTTY program is often booted in to interface with the ST-6, and take the chores away from the Model 15.

Enter the ATR-6800! The unit is provided with an assortment of cables which already have the special connectors required attached to one end, and several common plugs to mate with many types of amateur equipment. In order to receive signals, the ATR-6800 must, of course, be provided with receiver output. Unlike many other units which only accept speaker audio, albeit the most common input provided, the Microlog will accept digital (TTL), RS-232, or audio, depending on the mode, and with Morse will even accept a hand key. Now, that's versatility. Nevertheless, I connected the audio output of the SB-303 to the ATR-6800. Connecting the RCA-type plug, which was provided, to the prewired cable was all of a five-minute job.

Again, a great variety of outputs is available, from grid-block compatible keying for Morse to RS-232 on Baudot and ASCII. I selected the standard AFSK tones, which I fed to the SB-401 through another phono plug. Connection to a scope is optional; the input and output are enough to get you on the air.

Turning the transmitter on produced an unpleasant surprise: The transmitter keyed and stayed on, no matter what the status of the ATR-6800. Some quick diagnostics revealed the problem. I was feeding the audio directly into the SB-401, and depending on the presence or absence of AFSK out to activate the transmitter through the VOX circuit in the transmitter. Unfortunately, the AFSK was always present, transmit or receive. The designers thought of this, however, and one quick cut and jump was done to set the unit up for the correct mode of operation.

I recommend that if you are purchasing one you should specify whether you want to use the audio out to key a VOX circuit. The change is not difficult—if you have a factory representative there to do it, as I did!

Now we scanned the dial looking for stations. Several were noted in the eighty- and twenty-meter bands, and most could be tuned with little difficulty. Lacking an external scope, the method of tuning is a bit primitive, at best. One light is provided, labeled as a "Tuning Indicator." This light goes on and off with FSK signals, only it takes quite a bit of practice to get it to flicker just right.

As another aid, a "reference tone" is available. This is an onboard speaker that sounds a tone when you are tuned fairly closely. Only problems are that in a noisy shack, with the speaker blaring, the low level from the small internal speaker is a bit hard to hear, and the triggering is again somewhat ambiguous. Certainly, using an inexpensive scope on the provided outputs makes tuning in signals much easier.

Prior to initiating a call, several memory buffers are available to be filled with callsigns, CW identifier, etc. Using the SHIFT, CONTROL, and ID keys, this can be done relatively quickly. It, again, takes some practice to remember some of the function codes, but they are well detailed in the manual. The end result is a closing identifier that gives the station call in RTTY and Morse, then automatically switches to receive.

After an hour or so of receiving and fooling around, we try to make a few contacts. Problems with the transmitter and receiver aside (it's not the Microlog's fault that the Heathkit RTTY position prevents linking the units together for transceive operation), we set up on frequency and call CQ. After a few calls, an answer sweeps across the ether—and ol' fumble fingers strikes.

You see, there is no button marked "transmit" or "receive" on the Microlog. To transmit, you send a SHIFT-KN; to receive, a CONTROL-SK (the key is actually marked SK/RTN). Now, if you send a CONTROL/KN, instead of a SHIFT-KN, you go to receive, instead of transmit, and clear the buffers. SHIFT-AR, on the other hand, will also go to receive, but only when the text buffer empties out, useful for typing ahead, and SHIFT-BT will switch to RTTY mode from, say, Morse, again when the text buffer is empty. I don't think a SHIFT-SK does anything special.

Confused? Well I was, and when I relayed some of this to Microlog the answer I got was in the, "it makes mistakes harder" vein. It also makes smooth operation harder, guys! To illustrate, Fig. 2 is a summary of functions and their commands. One of the most obvious suggestions would be to label keytops with the SHIFTed or CONTROL function, just as they are now labeled with special Morse characters.

One of the advertised features of the ATR-6800 is that it can be hooked up to a computer to act as a terminal. It can be, but there are some problems. First of all, the normal 40- character-by-24-line display is a bit small for most work. Further, the system is set up so that lowercase is displayed when the shift key is depressed, backwards from most true terminals (modified TRS-80s excepted). Moreover, several of the commonly used symbols, such as brackets, up-arrow, and backslash, are not represented, and lowercase letters are a bit abnormal, with raised "p", "q", "g", and "y".

What is more intriguing is to use the ATR-6800 as a standalone computer itself, a possibility that is on the horizon. Several programs are currently available which allow the unit to output SSTV as three lines of six characters per line, function as a mailbox, autostart/WRU, or several other modes. All of these programs are available on tape, and load from a conven-

Continued on page 97

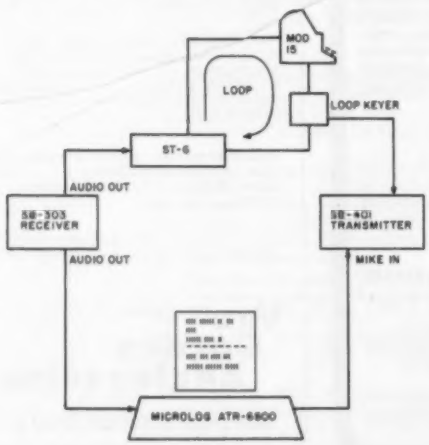

Fig. 1. Station wiring.

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LETTERS

R/CERS UNITE

I wish to express some opinions in regard to the recent FCC deregulation of the 6-meter band.

In a band use proposal, in Looking West, I was shocked to note the complete lack of consideration given to the radio-control enthusiast.

As I am sure you know, 53.1, 53.2, 53.3, 53.4, and 53.5 MHz are actively used by amateur radio operators for R/C purposes. Commercial as well as kit equipment is manufactured using these standard R/C frequencies.

Bill Pasternak WA6ITF mentioned in one of his follow-up reports that few if any negative comments were received by him regarding the 6-meter band proposal. Since these 6-meter frequencies are used by amateurs in R/C clubs throughout the United States, a change of this sort would not be welcome.

Further, the Academy of Model Aeronautics, the major R/C organization in the United States, also recognizes the present 6-meter frequencies as standard amateur assignment. I recommend that amateurs not interested in R/C work at least consider those that are.

It is unfortunate that many amateurs interested in R/C do not have interests in other modes of emission. This being the case, it is difficult to find out what is going on and what is being proposed. But, when we think about it for a minute: When was the last time any major amateur publication had *any* coverage on radio control?

Norman W. Pedersen KB6KQ
Bellflower CA

HAVE A STROKE!

This letter is addressed to all the kooks who have nothing better to do than QRM the traffic nets.

On August 21, 1980, my OM, W1GMA, suffered a massive stroke at 6:00 am Costa Rica time. Living way out in the country, we do not have a telephone. None of our near neighbors has a phone. It is four miles by road to the nearest phone.

My husband, "Doc," is a large man and I was unable to move him from the bathroom floor where he was unconscious. I hastily threw blankets over him to keep him warm and ran to the ham shack. I called in a triple break on 14313 where Dick KV4IJ was net control.

Dick said, "The person calling break break break...Do you have an emergency?"

I said, "You better believe it, Dick."

I identified and said that I thought my husband had just had a stroke and I had no phone. Could he raise someone in Costa Rica to get an ambulance for me? I gave instructions for the way to my home and within a half hour TI4FHC arrived followed by an ambulance.

This, my friends, is what ham radio is all about! Talk about service? I probably couldn't have done so well with a phone with my lousy Spanish.

I regret that the stroke was so massive that there has been little hope that I will ever regain the beautiful man I had the day before, but he is now at Walter Reed Army Medical Center and getting the best possible therapy. I have returned to Costa Rica temporarily, after a month in Washington. I will return to the states from time to time to check on his progress. When he is well enough, we will both return here to live the lovely life we have.

My profound gratitude to the 14313 nets, to TI4FHC, and to all who assisted in this ordeal. To the K4 who insists on operating ½ kHz above the net: *HAVE A STROKE!*

Kayla Hale W1EMV/TI5
Alajuela, Costa Rica

APPLIANCE USERS

With regard to the letter from Alan Davis KB7HM and Wayne's reply, "Let's hear it for the code-free, theory-free license," December, 1980, *73 Magazine*, I must agree that most modern day hams are appliance users.

With the state-of-the-art what it is, how many hams have the laboratory test equipment to produce commercial-quality ham equipment? It is cheaper to purchase the store-bought equipment, even if one could locate the components to build good ham equipment.

However, I cannot quite go along with the idea of the code-free, theory-free ham license. Eleven meters speaks against such a concept. Throughout the years, hams have been admired and respected for the effort that they were willing to put forth in order to obtain a ham license. Most hams do not regret having expended that time and effort. Of course, there always has been, and always will be those who want something for nothing, and this type of person keeps on demanding more. As a compromise to these something-for-nothing demands, I would like to offer the following suggestions.

Leave the frequency allocations for both CW and phone exactly as they stand at the present time. Those who wish to operate nothing but phone could be granted a code-free/theory-free license, which would allow them full phone privileges in all presently established phone bands. This could be handled in the same manner CB licenses are handled.

Those people who desire to upgrade their status from appliance user to radio operator and still retain full phone privileges would be required to pass the following code tests:

5-wpm code speed for operation in the Novice class CW bands.

13-wpm code speed for operation in the General class CW bands.

15-wpm code speed for operation in the Advanced class CW bands.

20-wpm code speed for operation in the Extra class CW bands.

All code tests except the 20-wpm test to be given by a certified volunteer examiner, being at least one grade above the person being examined. The 20-wpm code test should be administered only at a field office of the FCC. This proposition would take a lot of the work load off of the FCC and give them more time and money to chase rule violators, jammers, bootleggers, etc.

Many people who would like to become hams but have never been willing to buckle down and earn the license will probably find this stupid idea very appealing. However, I doubt that very many already licensed hams will find much appeal in this idea.

I know that if this proposal was to be carried out, it would not cure 100% of ham radio's ailments. However, it would give the freeloaders something for nothing and still leave something to be gained for those who were willing to expend a little bit of time and effort. Regardless of what a few people may try to lead us to believe, CW is by no means dead, and it still has its place in the radio hobby.

Verle D. Francis W0SZF
McCook NE

TREASURE ISLAND

Wayne, I enjoy your magazine now as I have for 15 years. No, your editorials are not too long for some of us, the mixture of nostalgia and modern topics blends into an interesting few minutes of reading.

Yes, at Treasure Isle in 1942-43, I did carve W6ECB into one of the desks that you apparently sat in at a later date and I was amazed that you copied several of the calls to remember 30 or so years later in one of your writings.

Like you, I joined the Navy in early 1942, took an accelerated EE (without calculus) course at the University of Houston, on to T.I., then to New London for sub school where I was detained for 18 months to teach code to some of the "90-day wonders"! I went to the South Pacific on the *Green Hornet* AS-23 sub tender, and had a few rides on the *USS Archer Fish* before ending the war in the Subic Bay! We heard stories about the *USS Drum* but we also had our hands full in the China Seas and I can't remember feeling necessarily sorry for you!

Amateur radio (W6ECB, licensed in 1934) has given me many friends, a Navy way of life, many hours of pleasure, many dollars spent, and many (40) years of married bliss (because I was home).

I agree that we must get more

Continued on page 94

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AWARDS

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This week I received a very nice letter from Lynn Hansen KAØCLQ who represents the Central Iowa Radio Amateur Club. In her letter Lynn provided me with the details of their new award entitled the Tallcorn DX Award.

TALLCORN DX AWARD

Applicants wishing to meet the requirements of this DX award program must confirm contact with three or more members of the Central Iowa Radio Amateur Club. While there are no band or mode restrictions, there is the need for complete and accurate logbook information for each contact made. This DX award is issued free, but, applicants are asked to submit a large business-sized SASE and 50 cents to defray cost of postage.

The members of the Central Iowa Radio Amateur Club are active in various modes of operation. You may find them on CW, phone, RTTY, and SSTV. Should you wish a single-band or specific mode qualification, I suggest you write the club directly and arrange a roster of the membership and at the same time arrange a schedule with a few of the operators.

Inquiries may be directed to the Central Iowa Radio Amateur Club, PO Box 39, Marshalltown IA 50158.

WORKED ALL LYNCHBURG LADIES AWARD

The Lynchburg Amateur Radio Club announces the availability of a new piece of "wall paper." This award, the Worked All Lynchburg Ladies Award, may be earned by working three YL members of the Lynchburg Amateur Radio Club. If you think that's difficult, sympathize with Lynchburg area amateurs. They must work five Lynchburg Ladies on modes other than repeater operation.

This award is available at no charge. The applicant should submit the usual logbook information and it would be advisable to enclose a small donation to offset any postage expense. Submit your entry to Rachel Bush, 1109 Dandridge Drive, Lynchburg VA 24501.

73 MAGAZINE AWARDS PORTFOLIO

If readers are still seeking copies of our detailed awards program, find your September and October, 1980, back issues, as all nineteen award incentives for both the domestic and DX award hunters are listed there. Each was designed to be the ultimate in operating achievement. Back issues of the September and October, 1980, editions are available by writing or calling our Bookstore.

SWISS BEAR AWARD

The New Bern Amateur Radio Club is sponsoring the Swiss Bear Award. This award will be given for working 3 different amateur stations in the New Bern area within the period of October 23, 1980, and October 23, 1981.

Extracts from logs for QSOs during this period, along with an SASE, or in case of DX stations two IRCs, should be sent to: New Bern Amateur Radio Club, Inc., PO Box 2483, New Bern NC 28560.

The Award consists of a certificate depicting the Swiss Bear, symbol of both Bern, Switzerland, and New Bern, North Carolina, and stating that the station has met the requirements for this award.

Glancing at my wall full of DX awards, it's staggering how much investment is represented just in postage costs to gather the required QSL cards to qualify for these achievements. Just as a guesstimate, I must have spent well over a thousand dollars in IRCs and greenbacks over the past three or four years. Well, the expenses for stateside confirmation aren't much better. Finally, however, we are pleased to learn of a new stateside QSL service that promises to relieve much of the formal expense in getting the job done. Known as the US QSL Service, it is founded and managed by N7BMY and KB7JW, both of Mulino, Oregon.

US QSL SERVICE

Can you believe it? One address for all your domestic QSLing, both incoming and outgoing, for all ten call districts, including Alaska and Hawaii? Unbelievable, you say!

Available now to all licensed amateurs in all fifty states, the service uses professional file clerks to ensure accurate, speedy, and ongoing QSL handling. Emphasis is placed on hiring the disabled, people who want to be self-sufficient but need an opportunity to do so. The service asks for a very minimal 25¢ for each incoming batch of up to 20 QSL cards. This covers wages and operating costs incurred in processing the correspondence.

In comparison, to show how the service can be of benefit to all of us, consider the present cost of sending twenty QSL cards. At 10¢ each, you'd spend $2.00 in postage alone. In addition, you have to look up all twenty addresses, which can be difficult, expensive, and more or less frustrating after you go through a stack of cards. Chances are some of the contacts were new calls, not yet listed in the *Callbooks*, or perhaps a new address has not yet been inserted in the present address listing. Need we say more? Now, to send these same QSL cards to the US QSL Service costs you up to 85¢ (30¢ postage, 30¢ on two SASEs, and 25¢ handling charge). Think of it this way: You have to only lick three or four stamps instead of 20!

Who are the founders and

Continued on page 100

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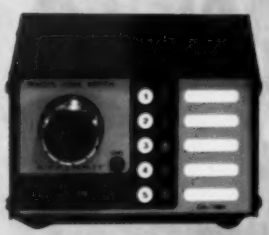

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REVIEW

YAESU FT-707 HF TRANSCEIVER

Checked any equipment prices lately? When it comes to equipment, hams have never been able to get so much quality and performance for so little money. The new Yaesu FT-707 HF transceiver is a good example. It offers features and performance equal or superior to top-dollar rigs of a few years ago. Today, the FT-707 is one of Yaesu's least expensive rigs. It says a lot for the state of the art when a relatively inexpensive transceiver offers the features this new Yaesu does. Let's take a good look at it.

The FT-707 is similar in size to rigs like the Kenwood TS-120S, the Icom IC-701, and the Atlas 150. It covers all present and planned bands between 80 and 10 meters, including the new WARC bands. The bandswitch itself has a very precise feel, clicking smoothly into place, rather than thunking noisily as do bandswitches on many other rigs. Just to the right of the bandswitch is the vfo knob which also seems to have been engineered for the proper feel.

Yes, the 707 has the digital frequency readout that we now take for granted on high quality gear, but it also offers a well-calibrated and easy-to-read analog display, useful when the companion external vfo and memory unit is in use. Just above the vfo knob are four status LEDs, telling which vfo is in use, if the marker generator is switched on or off, and whether a crystal-controlled frequency has been selected.

The Yaesu 707 line.

The display that attracts the most attention is the front-panel meter, which is a multi-segment bar-type LED display. The lower-value segments glow green, higher readings are yellow, and the highest readings show red. This display does more than impress your friends. It allows you to keep tabs on signal strength, relative power output, and alc level.

Whether LED displays are really better than regular meters has been a subject of much debate lately. For the purposes it serves on the 707, the LED display works admirably, particularly in mobile installations where a traditional meter would be difficult to read while maintaining safe operation of a vehicle.

Other goodies on the front panel include an effective noise blanker, an i-f shift control, a 25-kHz marker generator, VOX controls, an RIT control, and an eight-conductor microphone plug that permits scanning from the mike if the rig is equipped with the FV-707DM external vfo. Also worth mentioning are the rf gain control, fast/slow agc switch, and fixed-channel operation switch. Along with the usual antenna, key, and power connectors, the rear panel sports an rf output jack for use with transverters, and sockets for the external vfo and accessories. Yaesu has managed to squeeze a lot into a small package!

Hands-On

Unpacking a new rig and wiring it into the ham station is an activity that most hams enjoy, and the hams at *73* are no exception! We had the 707 and its accessories wired to ground, power, and our Alpha 374 amplifier in no time at all. The human engineering that went into this rig is obvious; few other rigs we've seen have interfaced with such ease. Like the Icom 701, this rig has a relay box that is necessary if you plan to use both an amplifier and the external vfo. Even if you will only use an amplifier, this accessory is worth purchasing; it makes interfacing much simpler.

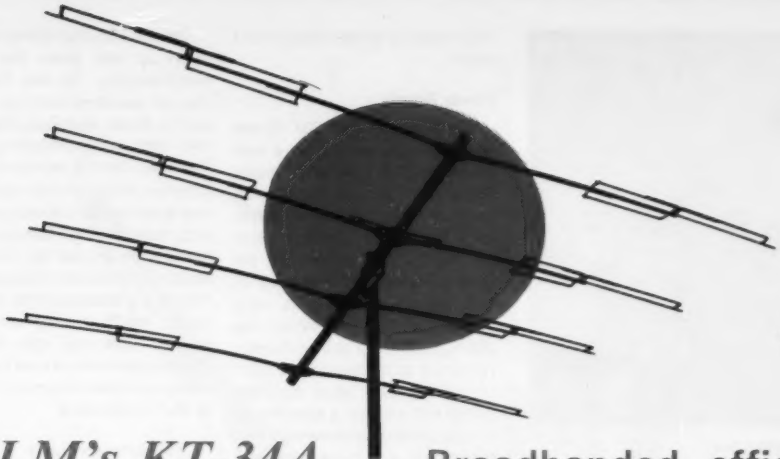
As soon as the rig was in place, the manual read, and basic operating parameters checked, we put the rig through the infamous *73* wringer. We connected the 707 to our Drake DL-1000 dummy load and checked the power output in the CW mode. A Bird wattmeter confirmed Yaesu's claim of full output on all bands. Our sample put out 100 Watts ±10%, with highest output on 80 and 20 meters, and lowest on 40 and 10 meters. Several other rigs we have tested have dropped by as much as 50% on 10 meters. The Yaesu's performance is admirable.

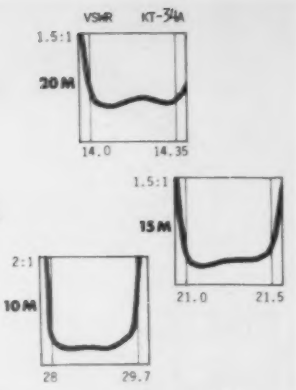
While we had the 707 on the dummy load, we checked out Yaesu's protection circuits. Like most of its solid-state brethren, the FT-707 finals are protected with a high swr shutdown device. As the swr climbs, the rig automatically reduces power to protect itself. Many rigs carry this to a fault, and almost any swr at all on the line causes a significant reduction in power output.

Yaesu's engineers seem well acquainted with the real world, and they designed the 707 to shut down only slightly at 2:1 or lower. Limiting action is heavy at 3:1 or higher, shutting the output down to a small percentage of its capabilities. This is a sensible arrangement, since many hams operate their equipment into transmission lines with moderate standing wave ratios. Further, a defect in the feedline or an improperly set coax switch will probably cause the swr to go much higher than 2:1. In short, the FT-707's ability to protect its expensive output devices is hardly curtailed, yet the annoying side effects of such protection have been mercifully banished.

Other protection circuits include a temperature-controlled fan and a thermal shutdown circuit. The instruction manual recommends a key-down period of no longer than 30 seconds, but we wanted to see how well the 707 protects itself, so we left it key-down for several minutes. Sure enough, the fan came on after a minute or so, and continued to run after switching over to receive. Having the fan run until the finals cool off is an excellent idea. Unfortunately, our unit was cursed with a noisy fan which rattled in a most aggravating manner. This was a problem peculiar to our sample, and it shouldn't be encountered in other 707s.

During normal operation the fan never came on at all, confirming that the fan is only a safety feature; the rig has





KLM's KT-34A . . . Broadbanded, efficient, compact!

Thanks for your interest in our KT-34A. We're glad to have tickled your curiosity. The KT-34A is a very special antenna, representing the first significant step forward for tribander design in 20 or more years. It is made for the amateur and the equipment of today, and advanced enough to meet the challenges of the future.

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Two driven elements are employed to make the KT-34A unusually **broadbanded** (a concept applied to most KLM antennas). VSWR and performance remain nearly constant across each of the three bands (see the VSWR charts). A KLM balun is supplied to allow direct feed from your 50 ohm coax.

Structurally, the KT-34A is built tough. No boom support is required. All the aluminum, including the boom, is strong weather resistant 6063-T832 alloy. All the hardware is stainless steel except for the mounting U-bolts. Virtually indestructable Lexan insulators support the elements and insulate them from the boom. Rotation is possible by most any ham rotor. Wind balance and wind survival are excellent. Boom length is only 16 feet.

To meet your future needs, the KT-34A is easily expandable. The KT-34XA Upgrade Kit, which adds two new elements and doubles the boom length, produces substantial increases in performance. Your KT-34A cannot become obsolete!

A great deal of thought and care has gone into the design of this antenna. It's not just another "me too" tribander, but one developed from modern techniques, materials and engineering. We hope you will give it a try. We know you won't be disappointed . . . .

KT-34A SPECIFICATIONS

Frequencies of operation:
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28-29.750
Gain: 7 dBd ± .3 dB across each band
F/S: 30 dB
F/B: 20 dB
Feed impedance: 50 ohms with balun supplied
Power rating: 4KW PEP
Boom: 16 ft. x 3" O.D.
Mast: for 2" O.D. (standard)
Element length: 24 ft. average
Turning radius: 16 ft.
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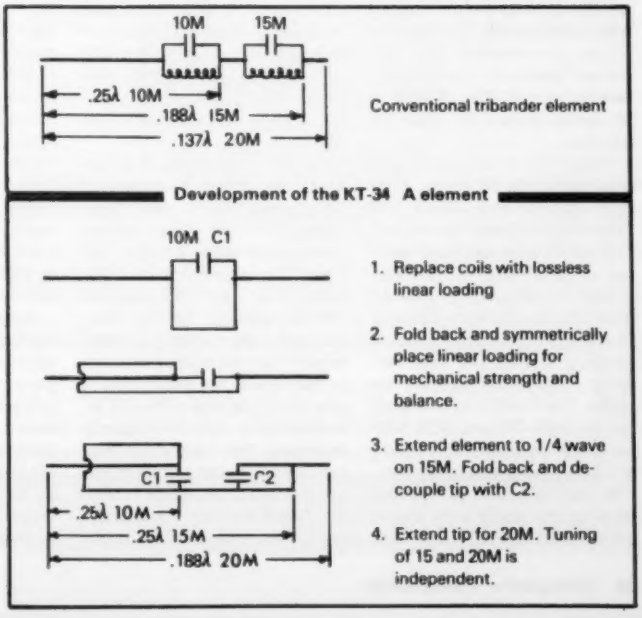
10M
15M
.25λ 10M
.188λ 15M
.137λ 20M
Conventional tribander element
Development of the KT-34 A element
10M C1
C1
C2
.25λ 10M
.25λ 15M
.188λ 20M
1. Replace coils with lossless linear loading
2. Fold back and symmetrically place linear loading for mechanical strength and balance.
3. Extend element to 1/4 wave on 15M. Fold back and de-couple tip with C2.
4. Extend tip for 20M. Tuning of 15 and 20M is independent.

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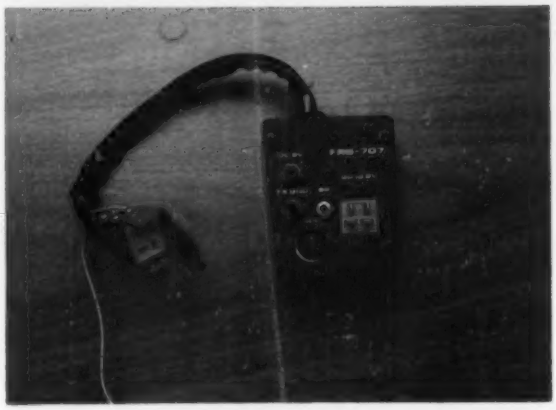

The FRB-707 relay box.

enough heat-sink area to dissipate the heat produced in normal operation. We never pushed the finals hard enough during any of our tests to cycle the thermal shutdown device.

On the Air

Operating the 707 is a pleasant and rewarding experience. Its no-tune-up design permits instant operation. Adjust the mike gain on SSB or the carrier level for CW to proper levels as indicated on the front-panel meter, and you are ready to go! Hams who have never operated a solid-state rig are in for an agreeable surprise.

While searching for DX on 20 meters one night, I noticed that tuning in individual signals seemed relatively easy with the 707. Sure enough, when compared to several other popular rigs gracing the *73* ham shack, the 707 came up with noticeably wider bandspread. The only rig in our possession that performed better in this respect was the Icom IC-701, whose digital tuning gives it an unfair advantage.

Selectivity is very good, with two eight-pole i-f filters standard. 600-Hz and 300-Hz CW filters are available as options. The 350-Hz filter was installed in our unit; switching it in provides a startling reduction in interference. Hams who enjoy CW (and Novices in particular) should consider a sharp CW filter necessary equipment for any receiver. The i-f width control is active on both CW and SSB, with performance comparable to other rigs having a similar control.

If you have always yearned for a rig that would allow you to check into an 80-meter AM phone net, or check out the action on 10-meter AM, you are reading the right review! Seriously, with the high level of interest in converted CB equipment, the AM feature allows entry into a world that is denied to owners of many other modern transceivers.

The quality of the manual also bears mention. For whatever reason, manuals for Japanese ham gear do not enjoy a particularly good reputation among hams in the USA. Well, I'm pleased to report that this is one of the good ones. While obviously written by someone for whom English is a second language, the instructions are perfectly clear and understandable.

Servicing information is pretty good, too. We are provided with complete schematics, block diagrams, and a very good circuit description. For those with access to good basic test equipment, there is a section on maintenance and alignment. We haven't seen too many manuals better than this for any transceiver, whatever its country of origin.

As with any piece of equipment, we found a couple of things we'd like to see Yaesu change; in this case, serious complaints were notably absent. The adjustment for sidetone level can't be reached without popping the top cover off—we'd like to see it located where it can be readjusted easily, perhaps on the back panel. It also would be nice if the 707 included some sort of a speech processor. Yes, I know that they are often misused, but there are times when a processor is useful. These are very minor problems, and I almost wish I could find more to gripe about, but I can't!

Power Supply

The matching FP-707 12-volt power supply would be a welcome addition to any shack. Regulation is very tight even under full load and the supply runs quite cool. (Except when testing the rig's protection circuits!) There is one feature of this supply that I was very pleased to discover. When you spend $150 on a power supply, you want to be able to get a lot of use out of it. Most supplies designed to match a specific rig have a special cable permanently attached and there is no way to use the supply to power anything else unless you tear into the case and add your own connectors. Yaesu has solved this aggravating problem by putting two multi-way connectors on the back of the supply, in addition to the cable that goes to the FT-707. These connectors are in the main output circuit and can provide the full supply current output, which is 20 Amps intermittent. Thanks, Yaesu! The power supply is also provided with a front-facing speaker, which performs well for a speaker of its size.

FV-707DM External Vfo

The FV-707 is a truly unique accessory; it changes the whole character of the rig. It resembles a traditional remote vfo in that it allows split-frequency operation, but there the resemblance ends. Measuring only one inch high, the FV-707 is designed to fit underneath the rig rather than beside it, and once installed it seems to become part of the rig itself. The FV-707 can be programmed to store 12 frequencies in its internal memories. Install two AA cells and those frequencies will be held for a year, even when power is turned off! This eliminates the need to buy crystals for often-used frequencies, and it allows an incredible flexibility of operation.

If you are a DX hound, you can scan up and down the band, searching for pileups, and program the frequency of a pileup into each memory, to be recalled later at your whim. If nets are more your cup of tea, the FV-707 will help you keep track of those as well. Indeed, the uses for these memories are limited only by your imagination!

The FV-707 also allows you to scan up and down the band electronically. On the front of the unit are three buttons, marked Up, Down, and Fast. The first two are self-explanatory, and the Fast button works in conjunction with the other two. Normal scan rate is one kHz per second; push the Fast button at the same time as the Up or Down button and the rate increases to 10 kHz per second. With the optional YM-35 microphone, frequency scanning can be accomplished in the same manner using switches mounted on top of the microphone.

FC-707 Antenna Tuner

Designed specifically to complement the FT-707, the matching antenna tuner is a compelling little box. Once you have an FT-707 in your possession, the matching tuner is hard to resist. It sports a lighted meter that keeps track of power output with reasonable accuracy, as well as serving as an swr meter. An unusual but extremely handy feature of this tuner is the built-in dummy load, switch-selectable from the front panel.

As far as the actual tuning circuit goes, it is important to realize from the start that this tuner doesn't intend to compete with the larger and much more expensive tuners on the market. Maximum power-handling capability is 150 Watts, and the tuner will only tune coax lines; there is no provision for random-wire tuning.

Still, the tuner performs its intended job well, which is reducing swr on coax lines. Just for fun, we tried tuning up a 15-meter dipole on 40 and 10 meters, and the FC-707 handled the job easily. Naturally, such a lash-up didn't work very well, but it did show off the tuner's capabilities! This little tuner should serve well in both mobile and home installations.

Conclusions

Either on its own, or with its accessories, the Yaesu FT-707 is a truly competent piece of equipment. If you are a compulsive knob twirler, you'll find the digital features of the external vfo impossible to resist. If your quest is for solid performance on both SSB and CW, the 707 offers that, too. Its extremely compact dimensions make it an obvious choice for mobile installations, yet the front-panel layout

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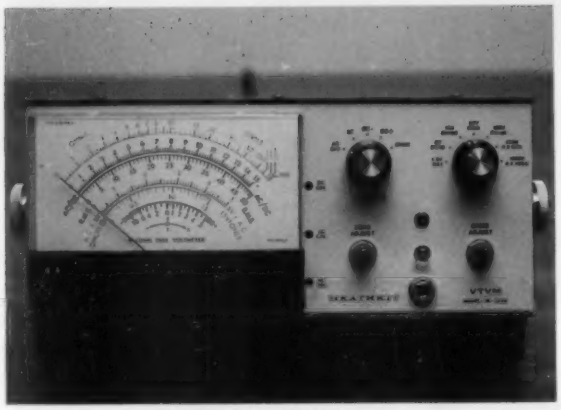

Heathkit's IM-5228 VTVM.

is such that it will be just as comfortable in a home station. If you have any interest in the new generation of compact, solid-state transceivers, this new Yaesu deserves your attention.

For further information, contact *Yaesu Electronics Corp., 6851 Walthall Way, Paramount CA 90723.* Reader Service number 485.

Paul Grupp KA1LR
73 Staff

HEATHKIT® MODEL IM-5228 VTVM

When I talk to hams who are thinking of buying a test meter, they invariably seem determined to get one of the fancy new digital meters. Now don't get me wrong, I don't have anything against digital meters; it's just that they aren't necessarily the best meter for everybody, particularly if the budget only allows for one meter. Digital meters are not much help when you are trying to interpret a fluctuating reading, and, of course, they tend to be more expensive then a comparable analog meter.

Recently, while shopping for a new meter for the *73* ham shack, I came across an old friend, the Heathkit IM-5228 VTVM. This VTVM is hardly new to the market; in fact, I think it has been around a lot longer than I have! But that's just what makes it interesting. After all these years, it's still one of the best test equipment values on the market.

The 5228 is a bench-type VTVM. It comes with a gimbled swivel mount that allows easy reading of the meter, no matter where you place the VTVM. A slightly more compact version of the same VTVM is available from Heath for 10 dollars less. Since the bench unit has all its controls on the front panel and also has a larger meter movement, we opted for that model.

The 5228 measures dc and ac volts and Ohms, and does so on enough scales to allow easy interpretation of any reading. I won't bore you by repeating all the specs here, since they're available in any Heathkit catalog, but I'll list a few to give you an idea of this meter's parameters.

The voltmeter section's ranges extend from 1.5 volts full-scale up to 1500 volts full-scale in seven ranges each for ac and dc. Maximum voltage capability can be extended to 30 kV with an inexpensive accessory probe. Input resistance is 11 megohms on all ranges, permitting accurate in-circuit tests without loading things down. The ohmmeter section will measure 0.1 Ohm to 1000 megohms in six different ranges.

The IM-5228 is capable of extremely accurate measurements, but final accuracy depends on how carefully the kit-builder calibrates his unit. Any test instrument will need recalibration from time to time, and the Heathkit people are quick to point out that one of the advantages of kit-built instruments is the owner's familiarity with the unit. This familiarity encourages the owner to periodically check the accuracy of his meter and align it when necessary, instead of blindly hoping that the factory calibration is still good.

The basic $69.95 kit uses two tubes, which means that the VTVM must be warmed up before use. A conversion kit is available which replaces the vacuum tubes with solid-state devices. We couldn't resist that convenience, so we ordered the conversion kit at the same time as the VTVM.

Construction

Assembly was straightforward and enjoyable. As is usual with Heathkit products, the instructions were clear and easy to follow. Parts identification was easy with the life-sized pictorial provided. The VTVM took about fourteen and a half hours to put together, working at a leisurely pace.

A few minor points should be kept in mind during assembly. Be aware that when directions indicate that a certain number of wires must be present at a soldering point, any wire passing through that point is counted twice: once entering and once leaving. Realizing this may save you a frantic search for something else to add to that connection!

The hookup wire provided was only just enough to do the job. If you cut your leads too long, you may run out. Also, the wire provided was all the same color. Different colors would have made it easier to check connections. Only one error was discovered in our assembly manual: On page 18, wires from lug 4, not lug 3, are to be left free.

It was extremely satisfying to find the VTVM working perfectly the first time it was plugged in. However, the solid-state modification was yet to come. If you plan to install this modification, it is simplest to do it during the initial assembly. The installation is not complicated, but it does require the desoldering and removal of several components. The modification took only a few minutes and the VTVM acquired no problems along with its new solid-state devices. Again, the unit worked immediately upon being plugged in! Construction was easy and the instructions were good. Even a novice kit-builder should have no problems with this one!

The Heathkit IM-5228 VTVM is an old friend in an attractive new cabinet. Hams looking for a high-quality but reasonably-priced voltage and resistance meter will find that this meter still represents one of the best values on the market.

Additional information is available from the *Heath Company, Benton Harbor MI 49022.* Reader Service number 486.

Alyson Grupp N1BEJ
73 Staff

KANTRONICS VARIFILTER

If you've never used an active audio filter to aid reception of signals, you ought to try the Kantronics Varifilter to improve your listening pleasure. What is a Varifilter? Good question. It's a variable filter with variable frequency and bandwidth, and it allows you to select a peak or a notch mode.

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Continued on page 89

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OSCAR ORBITS

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The OSCAR satellites are subject to atmospheric drag, of course, and the present period of intense solar activity has accentuated the problem. During this period, our sun has been expelling huge numbers of charged particles, some of which find their way into the Earth's upper atmosphere, increasing the density (and thus the drag) there. It is through this region that the OSCARs must pass. OSCAR 8, in a lower orbit than OSCAR 7, is the more seriously affected of the two.

If the drag factor is not considered when OSCAR calculations are performed, long-range orbital projections will be in error. For example, by the end of 1979, OSCAR 8 was more than 20 minutes ahead of some published schedules. The nature of orbital mechanics is such that extra drag on a satellite causes it to move into a lower orbit, resulting in a shorter orbital period. Thus, the satellite arrives above a given Earthbound location earlier than predicted.

Using data supplied to us by Dr. Thomas A. Clark W3IWI of AMSAT, the equatorial crossing tables shown here were generated with the aid of a TRS-80™ microcomputer. The tables take into account the effects of atmospheric drag and should be in error by a few seconds at most.

The listed data tells you the time and place that OSCAR 7 and OSCAR 8 cross the equator in an ascending orbit for the first time each day. To calculate successive OSCAR 7 orbits, make a list of the first orbit number and the next twelve orbits for that day. List the time of the first orbit. Each successive orbit is 115 minutes later (two hours less five minutes). The chart gives the longitude of the day's first ascending (northbound) equatorial crossing. Add 29° for each succeeding orbit. When OSCAR is ascending on the other side of the world from you, it will descend over you. To find the equatorial descending longitude, subtract 166° from the ascending longitude. To find the time OSCAR 7 passes the North Pole, add 29 minutes to the time it passes the equator. You should be able to hear OSCAR 7 when it is within 45 degrees of you. The easiest way to determine if OSCAR is above the horizon (and thus within range) at your location is to take a globe and draw a circle with a radius of 2450 miles (4000 kilometers) from your QTH. If OSCAR passes above that circle, you should be able to hear it. If OSCAR passes right overhead, you should hear it for about 24 minutes total. OSCAR 7 will pass an imaginary line drawn from San Francisco to Norfolk about 12 minutes after passing the equator. Add about a minute for each 200 miles that you live north of this line. If OSCAR passes 15° east or west of you, add another minute; at 30°, three minutes; at 45°, ten minutes. Mode A: 145.85-.95 MHz uplink, 29.4-29.5 MHz downlink, beacon at 29.502 MHz. Mode B: 432.125-.175 MHz uplink, 145.975-.925 MHz downlink, beacon at 145.972 MHz.

At press time, OSCAR 7 was scheduled to be in Mode A on odd numbered days of the year and in Mode B on even numbered days. Monday is QRP day on OSCAR 7, while Wednesdays are set aside for experiments and are not available for use.

OSCAR 8 calculations are similar to those for OSCAR 7, with some important exceptions. Instead of making 13 orbits each day, OSCAR 8 makes 14 orbits during each 24-hour period. The orbital period of OSCAR 8 is therefore somewhat shorter: 103 minutes.

To calculate successive OSCAR 8 orbits, make a list of the first orbit number (from the OSCAR 8 chart) and the next thirteen orbits for that day. List the time of the first orbit. Each successive orbit is then 103 minutes later. The chart gives the longitude of the day's first ascending equatorial crossing. Add 26° for each succeeding orbit. To find the time OSCAR 8 passes the North Pole, add 26 minutes to the time it crosses the equator. OSCAR 8 will cross the imaginary San Francisco-to-Norfolk line about 11 minutes after crossing the equator. Mode A: 145.85-.95 MHz uplink, 29.4-29.50 MHz downlink, beacon at 29.40 MHz. Mode J: 145.90-146.00 MHz uplink, 435.20-435.10 MHz downlink, beacon on 435.090 MHz.

OSCAR 8 is in Mode A on Mondays and Thursdays, Mode J on Saturdays and Sundays, and both modes simultaneously on Tuesdays and Fridays. As with OSCAR 7, Wednesdays are reserved for experiments.

OSCAR 7 ORBITAL INFORMATION FOR MARCH

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
28781	1	0114:49	98.4
28793	2	0014:08	68.2
28806	3	0108:22	93.8
28818	4	0007:41	78.6
28831	5	0101:54	94.2
28843	6	0001:14	77.1
28856	7	0055:29	90.6
28869	8	0149:44	104.2
28881	9	0049:02	89.1
28894	10	0143:17	102.7
28906	11	0042:35	87.5
28919	12	0136:50	101.1
28931	13	0036:08	85.9
28944	14	0130:23	99.5
28956	15	0029:42	84.4
28969	16	0123:56	98.8
28981	17	0023:15	83.8
28994	18	0117:29	96.4
29006	19	0016:48	81.2
29019	20	0111:03	94.8
29031	21	0010:21	79.7
29044	22	0104:36	93.3
29056	23	0003:54	78.1
29069	24	0058:09	91.7
29082	25	0152:24	105.3
29094	26	0051:42	90.1
29107	27	0145:57	103.7
29119	28	0045:15	88.6
29132	29	0139:30	102.1
29144	30	0038:48	87.0
29157	31	0133:03	100.6

OSCAR 8 ORBITAL INFORMATION FOR MARCH

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
15225	1	0037:22	67.0
15239	2	0042:09	68.3
15253	3	0046:56	69.5
15267	4	0051:43	70.7
15281	5	0056:30	71.9
15295	6	0101:17	73.1
15309	7	0106:04	74.3
15323	8	0110:51	75.5
15337	9	0115:38	76.7
15351	10	0120:24	78.0
15365	11	0125:11	79.2
15379	12	0129:58	80.4
15393	13	0134:45	81.6
15407	14	0139:31	82.8
15420	15	0001:06	58.2
15434	16	0005:53	59.4
15448	17	0010:40	60.6
15462	18	0015:26	61.9
15476	19	0020:13	63.1
15490	20	0024:59	64.3
15504	21	0029:46	65.5
15518	22	0034:33	66.7
15532	23	0039:19	67.9
15546	24	0044:06	69.1
15560	25	0048:52	70.3
15574	26	0053:39	71.6
15588	27	0058:25	72.8
15602	28	0103:12	74.0
15616	29	0107:58	75.2
15630	30	0112:44	76.4
15644	31	0117:31	77.6

OSCAR 7 ORBITAL INFORMATION FOR APRIL

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
29169	1	0032:21	85.4
29182	2	0126:36	99.8
29194	3	0025:54	83.9
29207	4	0120:09	97.4
29219	5	0019:27	82.3
29232	6	0113:42	95.9
29244	7	0013:00	80.7
29257	8	0107:15	94.3
29269	9	0006:33	79.2
29282	10	0100:48	92.7
29294	11	0000:06	77.6
29307	12	0054:21	91.2
29320	13	0148:36	104.8
29332	14	0047:54	89.6
29345	15	0142:09	103.2
29357	16	0041:27	88.0
29370	17	0135:42	101.6
29382	18	0035:00	86.5
29395	19	0129:15	100.1
29407	20	0028:33	84.9
29420	21	0122:48	98.5
29432	22	0022:06	83.3
29445	23	0116:21	96.9
29457	24	0015:39	81.8
29470	25	0109:54	95.4
29482	26	0009:12	80.2
29495	27	0103:27	93.8
29507	28	0002:45	78.6
29520	29	0057:00	92.2
29533	30	0151:15	105.8

OSCAR 8 ORBITAL INFORMATION FOR APRIL

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
15658	1	0122:17	78.8
15672	2	0127:03	80.0
15686	3	0131:50	81.2
15700	4	0136:36	82.4
15714	5	0141:22	83.7
15727	6	0002:57	59.1
15741	7	0007:43	60.3
15755	8	0012:29	61.5
15769	9	0017:15	62.7
15783	10	0022:02	63.9
15797	11	0026:48	65.1
15811	12	0031:34	66.3
15825	13	0036:20	67.5
15839	14	0041:06	68.7
15853	15	0045:52	70.0
15867	16	0050:38	71.2
15881	17	0055:24	72.4
15895	18	0100:10	73.6
15909	19	0104:56	74.8
15923	20	0109:42	76.0
15937	21	0114:28	77.2
15951	22	0119:14	78.4
15965	23	0124:00	79.6
15979	24	0128:46	80.8
15993	25	0133:32	82.0
16007	26	0138:18	83.2
16021	27	0143:04	84.4
16034	28	0004:38	59.9
16048	29	0009:23	61.1
16062	30	0014:09	62.3

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47 CFR Part 97

[FCC 80-634]

Petition for Reconsideration of Academy of Model Aeronautics Concerning Interpretation of Amateur Radio Service Rules To Allow a Nonlicensed Person To Operate an Amateur Radio Station To Control Model Aircraft

AGENCY: Federal Communications Commission.

ACTION: Interpretation of rule.

SUMMARY: The Commission's staff was asked to rule on the question as to whether a person not holding an amateur radio license could operate an amateur radio station to control model aircraft. The staff ruled that § 97.79(d) did not permit an amateur radio station to be operated by an unlicensed person for the purpose of controlling model aircraft since such use constitutes one-way transmission. The basis for the ruling was an interpretation of § 97.79(d) which permits unlicensed persons to participate in two-way amateur radio communications under the supervision of a control operator, but not one-way communications. The Academy of Model Aeronautics petitioned for review of this ruling by the full Commission. The Commission *en banc* affirmed the staff's interpretation.

ADDRESS: Federal Communications Commission, Washington, D.C. 20554.

FOR FURTHER INFORMATION CONTACT: Maurice J. DePont, (202) 254-6684.

SUPPLEMENTARY INFORMATION:

Adopted: November 6, 1980.

Released: November 21, 1980.

By the Commission:

1. The Commission received a letter, dated April 10, 1979, from Mr. Francis E. Morris of San Diego, California, inquiring whether a person not holding an amateur radio license could operate an amateur radio station to control model aircraft. By reply letter of May 18, 1979, Mr. Morris was advised that this was not permissible under Part 97 of our rules. The basis for the ruling was an interpretation of § 97.79(d) which permits unlicensed persons to participate in two-way amateur radio communications under the supervision of a control operator. The Commission's staff ruled that § 97.79(d) did not permit an amateur radio station to be operated by an unlicensed person for the purpose of controlling model aircraft since such use constitutes one-way transmission.

2. The Academy of Model Aeronautics (AMA), the petitioner in this proceeding, learned of the staff's letter to Mr. Morris. On August 27, 1979, AMA requested the Private Radio Bureau (Bureau) to reconsider its interpretation of Rule § 97.79(d). The staff did reconsider the ruling, and on October 15, 1979, advised AMA, through its attorney, Jack R. Smith, that the communications referred to in § 97.79(d) are meant to be two-way communications. The staff further advised AMA that the provisions of Part 97, unlike the Part 95 Radio Control Service Rules, did not extend operating privileges to non-licensed persons to control model aircraft. It is from this decision that the petitioner, AMA, now seeks review by the Commission *en banc*.

3. In its Petition for Review, filed November 14, 1979, petitioner presents three questions:

(a) Whether the Bureau erred in its construction of the term "third party"?

(b) Whether the Bureau improperly interpreted the Part 97 Rules in holding that the radio control provisions were not parallel in all respects to the Radio Control (R/C) Service Rules?

(c) Whether the Bureau's interpretation of "third party" is inconsistent with other Part 97 rules and with long-recognized Amateur practice?

4. At the outset, it will be useful to restate the principal issue in this proceeding. The question is whether or not a person, who is not a licensed amateur radio operator, should be permitted to operate an amateur radio station for the purpose of controlling a model aircraft. It is in this context that we believe that the matter should be addressed. It should also be noted that the Amateur Radio Service and the Radio Control Service are essentially different. The Amateur Radio Service is for technically-inclined persons who wish to learn about and experiment with radio communications equipment and operating techniques. On the other hand, the Radio Control Service is for anyone, whether technically inclined or not, who wishes to use radio for controlling a remote object.

5. One of the fundamental purposes of the Amateur radio service is the recognition and enhancement of the value of the service to the public as a voluntary noncommercial communication service. In furtherance of this aim, a licensed amateur operator may permit a non-licensed person, i.e., a third party, to participate in amateur radio communications from his station, provided that a control operator is present and continuously monitors and supervises the radio communication to insure compliance with the rules. An illustration of this type of third-party traffic is where United States military personnel stationed overseas, who are not amateur operators, are enabled to converse with their families back home via a two-way Amateur radio hook-up. To effect such communications, the countries involved must have assented to third-party traffic and licensed Amateur radio operators must be in control of the respective transmitting and receiving amateur radio stations. It is in this light that the the term "any third party" referred to in § 97.79(d) must be understood.[1] The resultant communications then become the "third-party traffic" which we have defined in § 97.3 (v) as:

> Amateur radio communication by or under the supervision of the control operator *at an amateur radio station to another amateur radio station* on behalf of anyone other than the control operator. (Emphasis supplied.)

Contrary to petitioner's assertion that § 97.79(d) is a broader section than § 97.3(v) and that it defines the scope of permissible participation by non-licensees in amateur communications, those two sections, as well as § 97.114[2] which specifies the conditions under which third-party traffic may be sent, are all inter-related and were in no way intended to provide for the non-licensed amateur communications which the petitioner desires. To hold that the third person referred to in § 97.79(d) includes a non-licensed person engaging in one-way communications to control a remote object is to strain for an interpretation of the rule to fit the petitioner's wish. Worse, it is yet another instance of chipping away at the basic requirement that only licensed operators be permitted to operate amateur radio stations. In our view, *bona fide* third-party communications, as described above, can be distinguished from one-way communications designed to control the movement of a remote object. Although an exception was made to the license requirement for two-way communications, we do not believe that it would be in the public interest to further extend this exception by interpretation of the rule to include one-way communications.

6. In its argument that the Bureau ignored the parallelism between the Amateur and the Radio Control Service Rules (which the petitioner insists exists) the petitioner misstates the basis and purpose of the proposed rule making in Docket No. 19572. That proceeding proposed amendment of Part 97 rules insofar as they pertain to the radio control of remote model craft and vehicles. The petitioner states that: "The purpose of the rules change, the Commission indicated, was to establish comparability between the rules governing like-type operations in the Amateur Radio Service and the Citizens Radio Service.'" However, a close reading of that Notice of Proposed Rule Making will reveal that it was the petitioner in that proceeding (also AMA) who "states a desire for comparability between the rules governing like-type operation in the Amateur Radio Service and the Citizens Radio Service." In fact, the objectives of the Commission's proposal allowing amateur radio stations to be used for control of remote models were simplification of station identification, logging, and portable operation; special provisions requiring the amateur transmitter to bear an identifying marker; and, provision for a maximum mean power output of one watt for transmitters qualifying for operation under these special provisions. In this connection, see *Rock Creek etc. Dist.* v. *County of Calaveras*, 29 Cal. 2d. 7, 9, 172 P.2d. 863, where the court said "the objective sought to be achieved by a statute as well as the evil to be prevented is of prime consideration in its interpretation." Nowhere is it suggested in the Commission's Notice of Proposed Rule Making in Docket No. 19572 that *all* of the rules relating to operation of a radio station in the R/C Service for control of a remote object would be carried over into the Amateur Radio Service when an amateur radio station is so used. This is an important point because much of the petitioner's argument arises from the fact that the staff's decision holds that the provisions of § 95.205(b)(6)[3] are not implicitly contained in the Part 97 rules relating to the use of an amateur radio station to control models. We turn to a fundamental rule of statutory construction to support the staff's position. In *People v. Valentine*, 28 Cal. 2d. 121, 142, 169 p.2d. 1, 14, the court held that where a statute, with reference to one subject contains a given provision, the omission of such a provision from a similar statute concerning a related subject is significant to show that a different intention existed.

The transmission or delivery of the following amateur radio-communication is prohibited:

7. Finally, petitioner alleges that the Bureau erred in adopting an interpretation of "third-party" that is inconsistent with other provisions of the Amateur Radio Service Rules and with Commission-accepted Amateur practice. Specifically, petitioner cites §§ 97.89 and 97.91 as conflicting with § 97.79(d), if § 97.79(d) is read to apply to two-way amateur ratio communications. We do not subscribe to petitioner's theory relating to those sections. The *definition* of amateur radio communications is contained in § 97.3(b). There, such communication is defined as noncommercial radio communication by or among amateur radio stations solely with a personal aim and without pecuniary or business interest. In §§ 97.89 and 97.91, the *uses* of an amateur station are set forth. It may be used to communicate with other amateur radio stations (two-way communications) or to control remote objects (one-way communication) (see § 97.89); or, to engage in certain kinds of additional one-way transmissions such as sending information bulletins, or conducting a net operation, as in a "round-robin" discussion (see § 97.91). Petitioner says that § 97.79(d) should have the term "two-way" in its provisions, and that, since it does not, a non-licensed person should be able to engage in *all* the types of communications permitted by §§ 97.89 and 97.91. We do not agree. The provisions of § 97.79(d) clearly contemplate only two-way communications. For example, that section requires a control operator to be present and continuously monitor the radio communications. Monitoring in § 97.79(d) refers to message content. It would be ludicrous to believe that the Commission would require monitoring of a steady hum or tone-signal, which is the type of signal that is used in a typical one-way communication designed to control a remote object.

8. Petitioner further states that, under the Bureau's interpretation, there must be two-way communications established between unlicensed amateur radio operators before a non-licensee may participate. Petitioner further argues that, if followed through, the Bureau's interpretation would prevent, for example, a non-licensee from sending an informational bulletin at a licensed station, addressed in general, to "all amateurs", since there is no contact with another station involved. We could not agree more. That is precisely what § 97.91 does. It requires that only licensed amateur radio operators send such general bulletins over the air. It is interesting to note that, in practice, it is the American Radio Relay League's station W1AW from which the bulk of such bulletins emanate. All of the persons at the League's headquarters who send such bulletins are duly licensed amateur radio operators. Persons sending such bulletins from any other amateur radio station are likewise expected to be licensed operators. Moreover, in the "round-robin" discussions that § 97.91 allows, it is licensed operators, with an interest in such net operations, that the rule contemplates.

9. Petitioner offers a hypothetical case where Licensee A operates a repeater equipped with "autopatch" (a way of connecting an amateur radio station to the telephone landline circuits). The station in repeater operation operates under A's call sign and A is the control operator. Given these facts, petitioner says that if A makes an autopatch call it would be unlawful under the staff's interpretation of § 97.79(d) because communications between amateur stations do not exist. Petitioner further says that another amateur station that uses the repeater to make an autopatch

Continued on page 101

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[1] Section 97.79 Control operator requirements.

(d) The licensee of an amateur radio station may permit any third party to participate in amateur radio communication from his station, provided that a control operator is present and continuously monitors and supervises the radio communication to insure compliance with the rules.

[2] Section 97.114 Third party traffic.

(a) International third party traffic except with countries which have assented thereto.

(b) Third party traffic involving material compensation, either tangible or intangible, direct or indirect, to a third party, a station licensee, a control operator, or any other person.

(c) Except for an emergency communication as defined in this part, third party traffic consisting of business communications on behalf of any party. For the purpose of this section business communication shall mean any transmission or communication the purpose of which is to facilitate the regular business or commercial affairs of any party.

[3] Section 95.205 Operation by, or on behalf of, persons other than the licensee.

. . . . .

(b) Stations may be operated only by the following persons, except as provided in paragraph (c) of this section:

. . . . .

(8) Any person under the control or supervision of the licensee when the station is used solely for the control of remote objects or devices, other than devices used only as a means of attracting attention; and

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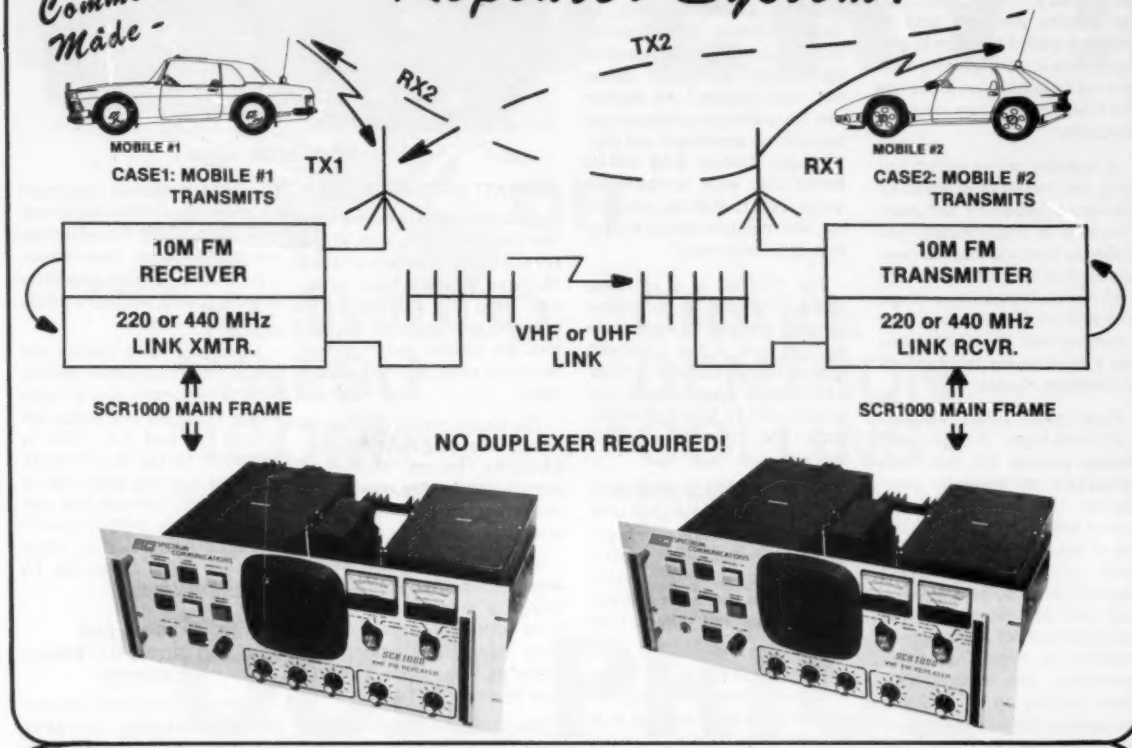

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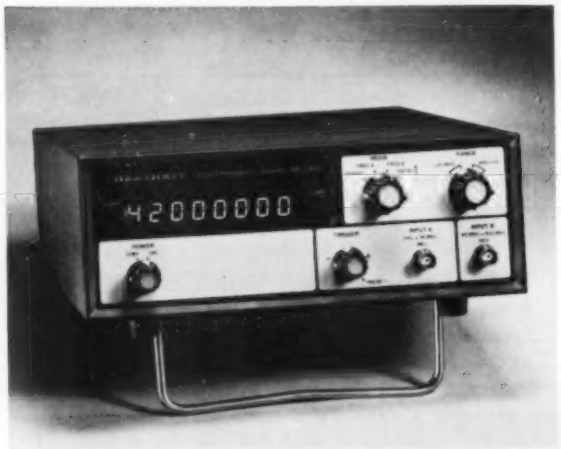

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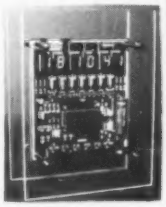

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The ZL/DF Special

— your next T-hunt could be a hare-raising experience

Jane Rice AD6Z
3130 Morningside Drive
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When our local radio club formed a two-meter T-hunt group, my OM and I decided, after tagging along a few pleasant Sunday afternoons, to put together some sort of simple antenna and join in on the fun of rabbit hunting. We noted that the most successful hunters in the group took up pursuit with four-element quads or yagis. However, we also noted that a four-element quad or yagi has a boom length of about six feet and that the various home-brew devices used to attach this impressive but awkward length to a vehicle looked a bit tricky to construct.

Willing to put out a moderate amount of effort, we agreed that any antenna we built would require no complicated car mounting, that it would be light and small, that it could be flung together cheaply and easily in a few spare hours, and that it would aim us generally in the direction of a hidden transmitter.

Since we had no experience building direction-finding equipment, we didn't realize that our specifications weren't easy to fill until we'd assembled several trial configurations. With most, we used up a lot of gasoline and the rabbits got away.

We tried loops, but had no luck getting a sensor to choose between the two major lobes in the loop's response pattern. Then we tried phased quarter-waves that stubbornly exhibited a radiation pattern reminiscent of a lace doily. Finally,

The completed antenna is mounted through the wind-wing of a car.

Mathematical premises used in this article

A. λ in free space = 984 ÷ MHz (for feet) or 11808 ÷ MHz (inches).
B. λ/2 in free space = 492 ÷ MHz (for feet) or 5904 ÷ MHz (inches).
C. K-factor of 300-Ohm twinlead at two-meter frequencies = .965.
D. Velocity factor of 300-Ohm twinlead = .82.
E. Length of λ/2 folded dipole made from 300-Ohm TV lead-in at 146.5 MHz is 5904 × .965 ÷ MHz = 38-7/8".
F. Velocity factor of RG-59/AU coax = .66.
G. Electrical λ/4 of RG-59/AU at 146.5 MHz is: (11808 ÷ 4 × .66) ÷ 146.5 MHz = 13-1/4".

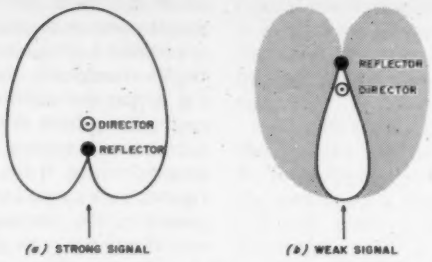

Fig. 1. Response pattern of ZL special. In (a), the director and reflector are positioned so that the null indicates the direction of a fairly strong transmitted signal. In (b), the antenna has been rotated 180 degrees to get a peak bearing on a very weak signal. Gray areas represent that part of the normal response pattern that is lost when receiving weak signals.

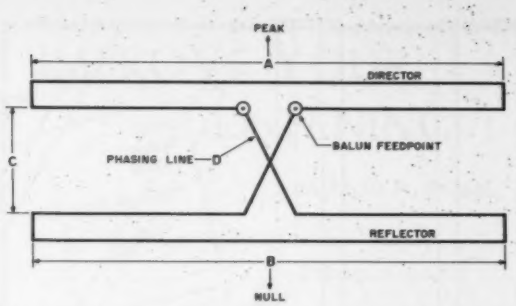

Fig. 2. The ZL Special is composed of two phased driven folded dipoles made from 300-Ohm twinlead. The driven director is 4.4% shorter than a half-wave element and the reflector 1.7% longer. Formulas for dimensions in inches: A = 5446 ÷ MHz; B = 5794 ÷ MHz; C = 1266 ÷ MHz; D = 1266 ÷ MHz. Dimensions for 146.5 MHz are: A = 37-1/8"; B = 39-1/2"; C = 8-5/8"; D = 8-5/8".

when we were on the verge of reconsidering quads and yagis with a less critical eye, one of the more knowledgeable old-timers in the area recounted his successful T-hunting experiences using a two-meter ZL Special and suggested we try one of those.

In an old edition of *The ARRL Antenna Book* and in further reading (see references), we found plans for low-band horizontal ZL Specials. Scaling one down to two meters and upending it to a vertical position seemed to present no problems, so we built it. Happily, it worked, more than fulfilling our original optimistic requirements. The completed antenna shown in the photograph weighs one pound, has a turning radius of thirteen inches, and is easily disassembled.

Car mounting is accomplished by setting a wooden closet pole through the wind-wing and into a five and one-half ounce juice can that is screwed to the car floor. Cost of materials is under ten dollars and construction time under two hours.

As for aiming us in the right direction, we can claim without modesty that we have ferreted out our fair share of hares.

Response Pattern

The modified ZL Special presented here consists of two driven folded dipoles phased to produce a cardioid (heart-shaped) pattern. As seen in Fig. 1(a), this unidirectional pattern exhibits a very sharp null in received signal strength when the driven reflector is exactly between a transmitted signal and the driven director. This null gives a more precise indication of signal direction than the broader peak readings, so following the null makes best use of the antenna while DFing.

An exception occurs when the transmitted signal is extremely weak. In such cases, the sharp null pattern will be lost at the receiver, and it becomes necessary to rotate the antenna 180 degrees to follow peak readings. As the distance between hunter and rabbit narrows, the peak readings become broad and the antenna is again turned to utilize the null. The null will continue to indicate direction even when working extremely close to the hidden signal source.

Directivity and Gain

In addition to its compact size, the ZL Special has another unusual characteristic that makes it ideal for T-hunting: It combines excellent directivity with low gain. Front-to-back ratio is in the neighborhood of 22 dB while forward gain is only about 3 dB.

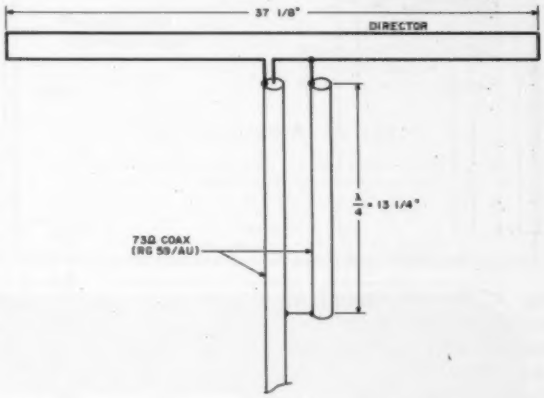

Fig. 3. Dimensions given for the 1-to-1 balun are for 146.5 MHz using coax with a velocity factor of .66. For other frequencies, balun length in inches is calculated from 2952 × .66 ÷ MHz.

The low gain is an asset because, contrary to what is often assumed, it is more difficult to locate the source of a strong signal than that of a weak signal. A strong signal, when close enough, will saturate the receiver's front end and pin the signal strength meter regardless of the antenna's bearing, completely wiping out all DF capability.

One disadvantage of using quads or yagis for DFing is that each element that is added to sharpen directivity incidentally increases gain. Signal attenuators, an essential item with any T-hunt antenna, compensate for much of the problem; but given equal situations, a low-gain antenna such as the ZL Special will maintain its directivity closer to a signal source than a high-gain antenna.

Polarization

When first trying out the antenna, we assembled it so that polarization was vertical. Results were fairly good, but proximity to the car body caused some pattern distortion. This problem was greatly reduced by tilting the antenna framework 30 degrees from vertical. As a bonus, the array also seemed less apt to re-

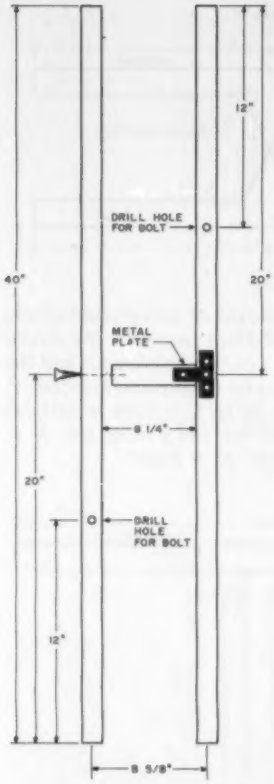

Fig. 4. The ZL Special is tacked to this framework made from ¾-inch-square wood. Dimensions given are for an antenna cut for 146.5 MHz.

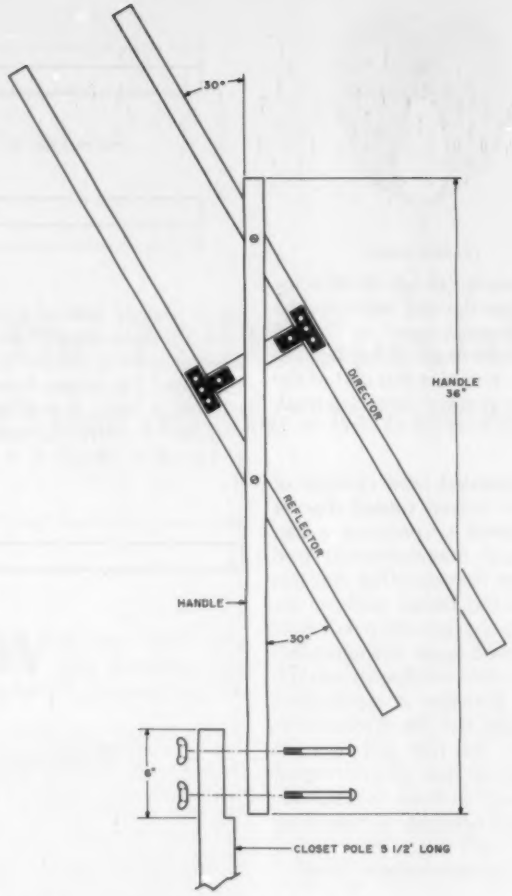

Fig. 5. The positioning of the "H"-shaped framework on its handle determines the tilt of the antenna. The handle is then bolted to a 1¼" wooden closet pole.

spond to signal reflections from nearby signposts, power poles, etc.

Spacing and Phasing

For the best front-to-back ratio, spacing between the two driven elements should be close to .123 wavelengths. Designs should never employ less than .1 wavelengths because pattern distortion and characteristic impedance changes will result.

In our antenna, .112 (one-ninth) wavelengths was used because it happened to be the spacing needed to accommodate the phasing line section. In calculating spacing (as well as element lengths), a K-factor of .965 is assumed for the twinlead at two-meter frequencies. The standard wavelength formula (984 × .965 ÷ MHz), with results divided by nine, is suitable. In Fig. 2, the formula given for spacing, although simplified, is identical except that the one-ninth wavelength will be in inches rather than feet.

The phasing line in the ZL Special acts as part of the transmission line. Its purpose is to provide, as closely as possible, the 135 electrical degree phase difference between director and reflector that is required for the cardioid pattern.

Assuming a velocity factor of .82 for the 300-Ohm twinlead, an electrical halfwave at 146.5 MHz is 492 × .82 ÷ MHz, or 2.75 feet. Then the 180 degrees in the half wavelength divided by 2.75 feet equals 65.36 electrical degrees per foot. Therefore, a piece of 300-Ohm twinlead that is .72 feet long will yield (by .72 × 65.36) 47 electrical degrees. This figure, when combined with a 180-degree twist in the phasing section (shown in Fig. 2), comes close to ideal phasing. Actually, 360° − (180° + 47°) = 133 degrees. The formula for phasing line length given in Fig. 2 was derived in the manner just described and will provide 133 electrical degrees at any chosen two-meter frequency.

The fact that the phase shift is two degrees less than ideal and that the element spacing is .011 wavelengths less than optimum is justified from a constructional standpoint. Note in Fig. 2 that the phasing line and spacing have the same dimension, making construction easy. If the ideal figures were carried to construction, the phasing line would turn out to be shorter than the space between elements, and the elements would have to be bowed in to make ends meet.

Construction

For antenna elements and phasing line, the use of lightweight 300-Ohm twinlead is recommended as it is easier to work with than a heavily insulated type. Formulas for dimensions and their application to 146.5 MHz are given in Fig. 2. Especially note the twist in the phasing section. A quarter-wave 1-to-1 balun, made from the same coax as the transmission line, is added at the director feedpoint to prevent unwanted currents from flowing on the coax transmission line. Details are in Fig. 3. The balun will not affect the impedance at the antenna feedpoint, generally reported to be about 70 Ohms. 73-Ohm coaxial cable (RG-59/AU) will provide a suitable match to both the antenna and a 50-Ohm receiver. When used for transmitting, the antenna exhibits an swr of 1.5 to 1 at design frequency and, compared to a dipole, is relatively broad-banded.

After the antenna is completed and the transmission line and balun soldered in place, the assembly is attached to its wooden support by driving tacks through the center of the twinlead. Electrical tape will suffice to hold the feedline and balun to the wooden handle. Care must be taken to maintain even spacing between the transmission line and balun, and spacers (about ½") may be necessary.

Construction details of the support framework and dimensions for a 146.5-MHz antenna are shown in Figs.4 and 5. The framework is a wooden "H" made from ¾-inch stock. The crossbar on the "H" is first screwed in place and then the joints are reinforced by adding narrow metal T-plates. The handle, of the same stock, is bolted to the framework at points that determine the 30-degree tilt. Make sure that the reflector, not the director, is bolted closest to the bottom of the handle. Finally, the handle is bolted to a 1¼"-diameter wooden closet pole that has one end rabbited to provide a flat surface.

After the juice can has been screwed to the car flooring and the antenna is in place, mark the pole at eye level to indicate the antenna's heading. A marker that can be felt as well as seen is convenient. We used a small rubber screw-in foot, like those found on the bases of radio gear, to indicate the direction of the null.

Since the highest point of the antenna will be about six feet above the roof of the car, keep a sharp eye out for trees with low branches and you will greatly extend the life-span of your ZL Special! Good hunting! ■

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3. Jordan, Gary Blake WA6TKT, "Understanding the ZL Special," *Ham Radio Magazine*, Greenville NH, May, 1976, pages 38-40.
4. Kraus, John D., *Antennas*, McGraw-Hill, New York, 1950, chapter 11-4.

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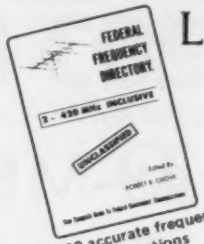

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A 49-MHz Repeater

—fun project

Any experimenter who has ever pondered the potential of the new license-free 49-MHz band can't help but see freedoms from regulations to experiment here that are denied in ham radio. For instance, a transmitter operating here isn't required to identify by callsigns, nor is it limited to any particular emission. While most hams might not consider this a handicap, an experimenter who requires a radio transmission of short range, as in the case of telemetry, can avoid a lot of inconvenience and cost by using 49 MHz instead of a regular ham band.

I was playing around with several inexpensive 49-MHz transceivers (the two-for-$20 variety) when the idea of a truly license- and restriction-free repeater came to mind. Now, these transceivers run about 20-40 milliwatts of power and have a range of about one-quarter to half a mile, depending on terrain. They have regenerative receivers which don't help the range much, but any VHF ham will agree that 40 mW with a proper antenna and a good receiver will cover distances considerably greater than this. All one has to do is look at the hundreds-of-square-mile ranges of certain repeaters in this country that don't use much more power to see the possibilities.

I didn't expect, or want, distances like this, but being an experimenter at heart, I took up the challenge of 49 MHz to see just what could be possible on this band.

Building the License-Free Repeater

The repeater transmitter was simple. One of the transceivers was sacrificed and altered to stay in transmit-only mode and modified to accept audio from a receiver instead of using its built-in mic. The original frequency of 49.86 MHz was changed by replacing the transmit crystal with one 30 kHz towards the band edge. A quarter-wave antenna was fashioned out of copper wire and the whole assembly enclosed within a six-foot piece of large-diameter PVC pipe. A waterproof connector allows power and audio to be fed to the transmitter through the pipe over a multiconductor cable. Rf chokes and capacitors at this connector bypass and keep down stray rf that could end up down at the receiver. This transmitter/antenna can now be mounted at a reasonable height. The antenna attached to the transmitter is an apparent legal requirement on 49 MHz, but it works to an advantage here.

The receiver used for the repeater was located indoors and connected to a vertical half-wave dipole separated from the transmitter by one hundred feet. It consisted of an old surplus URR-22 receiver with an Ameco CN 50 converter. The repeater transmitter offset from 49.86 caused no desensitizing. That's all there is to it. Notice that since there is no requirement for identification, there is no CW identifier. Also, since there is no requirement against a continuous carrier, the transmitter is left on continuously. The receiver has an added squelch so that the carrier remains quiet except when rebroadcasting a received signal. How simple could it be? No COR, no ID, no time-out timers!

The transceivers all come set to operate on 49.86, so the repeater receiver is tuned to this frequency. Since the transceivers have regenerative receivers, a change of 30 kHz doesn't require much, if any, tweaking to bring them on the new repeater channel.

How Well Does It Work?

With the antennas thirty feet up, communications have been consistent to one-half mile between units and over a mile on numerous occasions. A half-square-mile coverage is about the expected range, which isn't bad when considering that this is supposed to be low-power, license-free radio.

An added bonus to this system is that the continuous repeater carrier quiets the rush noise from the inexpensive regenerative receivers and acts like a squelch. Also, as long as the receiver is quieting, the operator is sure he is within range of the repeater.

I haven't polished the system up any more than described. A better solid-state repeater receiver, more attention to the transmit/receive frequency offset, better transceivers, and so on would no doubt improve the system. It should be obvious that such a repeater could lend itself well to events covering small geographical areas like hamfests, county fairs, or Boy Scout jamborees. No one needs a license to operate, the equipment couldn't cost less, and 49 MHz is free (for now, anyway) of any interference.

If not a repeater, I hope that this article will spark other interesting ideas for using 49 MHz, an experimenter's delight. ■

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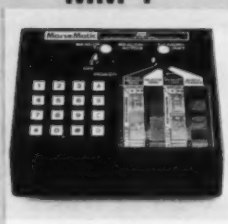		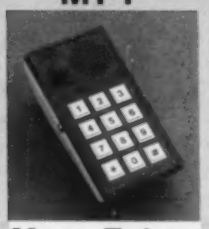		
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Independent Dot & Dash (Full) Weighting	Yes	Yes	Yes	Yes	Yes	No	No	No	No
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Calibrated Beacon Mode	Yes			No		No	No	No	
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Instant Start From Memory	Yes			Yes		No	No	Yes	
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TR-7400 Behind Bars

—something new in S-meters

One day while evaluating various LED bargraph displays at the workplace, my thoughts momentarily turned to ham radio. "Hey," I thought. "This bar graph would make a terrific S-meter on my two-meter rig!"

But could it, and the circuitry, be made to fit? I was sure it could, as I have had the meter out of the TR-7400 to replace the lamp bulb. The only questions remaining were: (1) What is the drive level of the existing meter, and (2) could the drive level be used to drive the display without need of an extra amplifier?

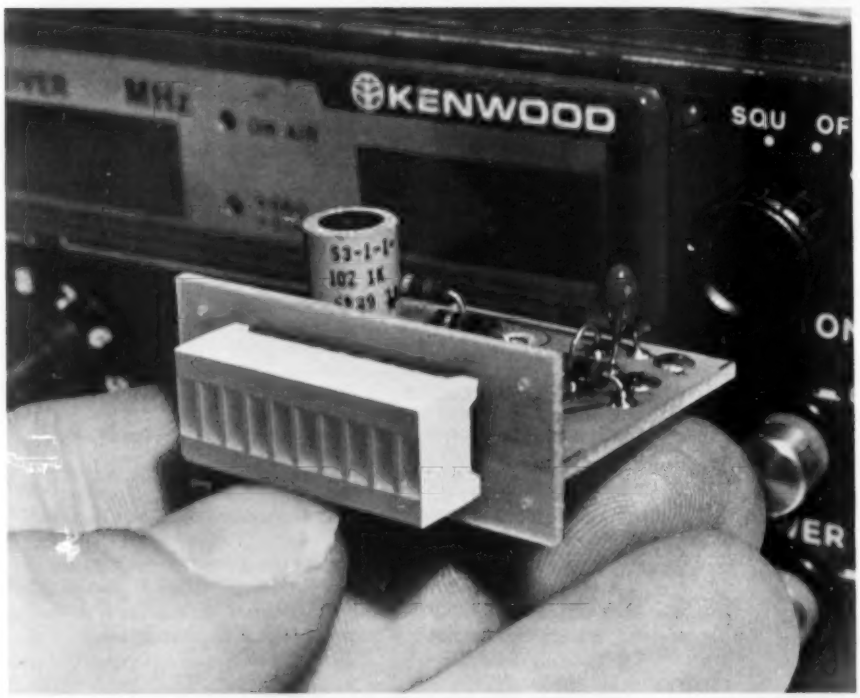

Photo A. Completed unit ready for installation. Note the two-board construction.

Upon arriving home that evening, a little tinkering with the rig was in order to determine the needed circuitry and circuit-board configuration for the conversion. I have always been one of those who has to build everything on a printed circuit board.

I found that the resistance of the meter was around 600 Ohms and that a dc input of 0.3 V was developed across it at a full-scale reading. I also discovered that this voltage increased to nearly 6 volts if the meter was taken out of the circuit. A quick look at the TR-7400 schematic revealed that a simple diode rectifier and capacitor circuit was used to drive the meter.

The circuit appears twice in the Kenwood, as the meter also reads relative output power in the transmit

mode. Each circuit has an adjustment pot inside the rig for trimming the meter. This feature could come in handy later.

Some further experimentation indicated that with a higher resistance load (greater than 600 Ohms), I could get the 1.2 volts needed to drive the bar-graph IC to full scale. I now knew that all the major questions concerning the conversion were answered. I then quickly started design of a PC board. The PC board quickly evolved into a pair of boards.

Sometime in the wee hours, the boards were made, tested, and installed solidly within the TR-7400. The new indicator functioned perfectly and looked as if it had been designed in from the start. The moving bars added quite a touch to the old rig.

The response time of the bar graph is much quicker than that of the old mechanical meter due to the lack of mechanical damping.

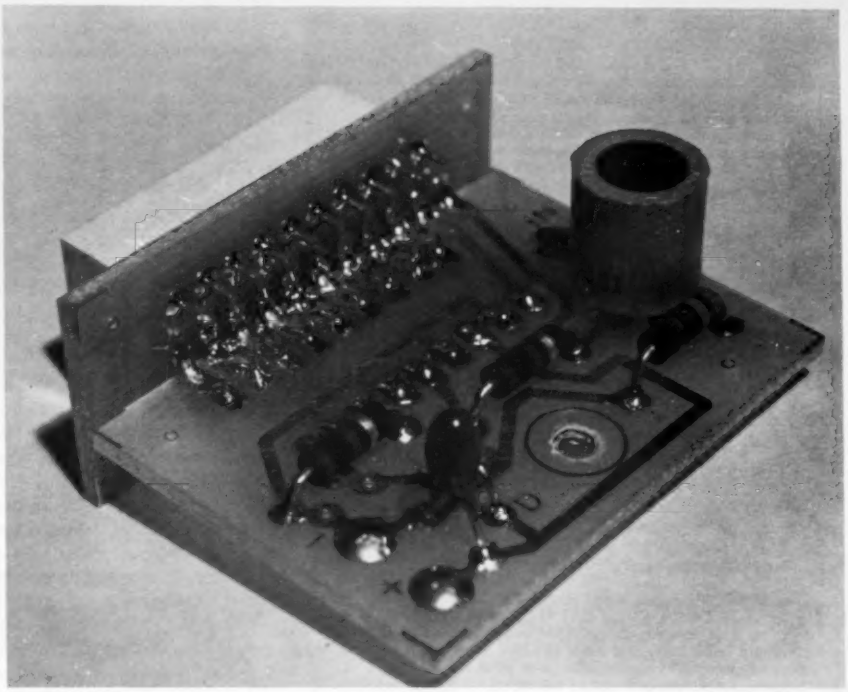

Photo B. The two boards joined using the rows of large pads. The IC is mounted underneath the board.

Circuitry

The heart of the circuit is the National Semiconductor LM3914 dot/bar display driver. This is an amazing IC in an 18-pin DIP. The LM3914 senses an analog voltage and drives ten LEDs, providing a linear graph-type display. All drive for the LEDs is self-contained within the IC, thus eliminating the need for external limiting resistors. LED drive control is provided, however, by selecting only one resistor value. Supply voltage may range from 3 to 15 volts without affecting display brightness. Some caution must be exercised at higher voltages, however, as dissipation in the IC may exceed the safe level. I used the regulated 5-volt source within the Kenwood to drive the display.

The schematic (Fig. 1) shows the circuit to be straightforward. The variable resistor and R1 allow some scaling of the input voltage for calibration. The values may be changed to suit other installations. Remember that 1.2 volts is needed at pin 5 of the LM3914 to drive it full scale. Resistor R3 deter-

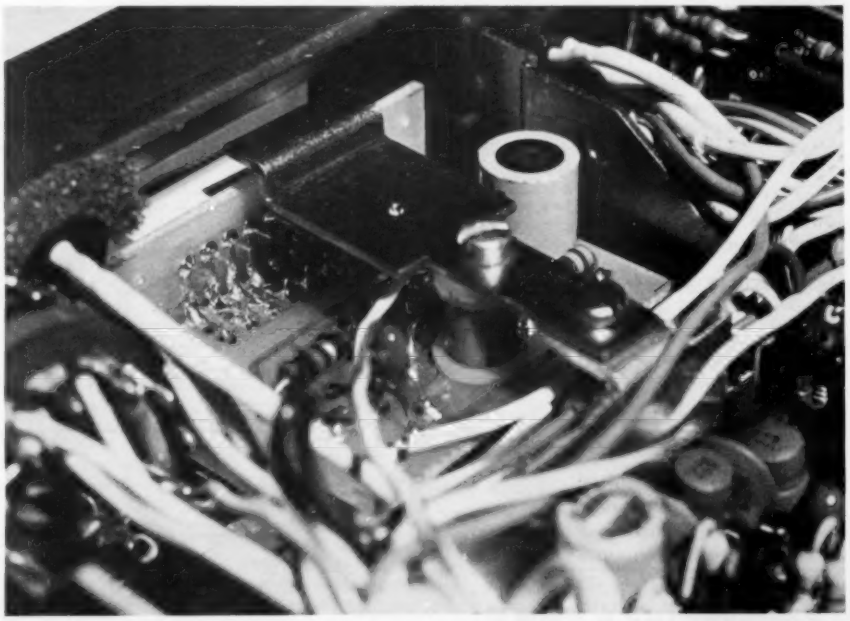

Photo C. Completed circuit installed within the 7400. About 4/10" is needed between the board and bracket.

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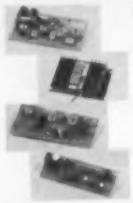

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mines the display brightness; ten times the current flowing in R3 will flow through an LED. The voltage at pins 6 and 7 is equal to 1.2 volts. LED current is 1.2 V/1k = 1.2 mA × 10 or 12 mA. R3 may be made larger if less current is desired. The jumper from pin 9 of the LM3914 to ground puts the display into the bar-graph mode.

Construction

As the circuit is uncomplicated, layout is not critical. I used the pair of small circuit boards shown in Photo A. The boards make a nice clean installation and ease the job of centering the display. In my unit, I mounted the IC on the non-foil side of the board.

The resistors and trimmer are mounted on the foil side. This makes adjustments readily accessible. Also, the Kenwood has very little room beneath the meter opening.

Photo B shows how the two boards are mated and soldered in place using the flat foil pads on the boards. Be sure the boards are perpendicular and straight when soldering in place. An alternative mounting would be to use ribbon cable as an interconnect between the two boards. This would allow some freedom as to the location of the larger board.

Installation in the TR-7400

Before mounting the display into the rig, you should verify how far the old meter deflects for some reference input signal. Something that causes almost a full-scale reading is best. This will be used to adjust the new meter to compare with the old one. Remove the old meter, bracket, and connections to the meter. The hole in the center of the new meter will be used for mounting. A 4/10''-long spacer is needed between the board and the mounting bracket. One with a threaded #4 hole is ideal. The old meter bracket will need a hole drilled in it so the PC board can be attached using the spacer and screw. Take care in measuring the location of the mounting hole. You want the bar-graph readout to come right up to the front glass in the rig.

Adjustment

After satisfying yourself that the unit is mounted and aligned correctly, connect the black wires from the old meter to the minus pad on the circuit board. Connect the wire that was on the high side of the meter to the signal input on the board. A new wire must be run for the +5-volts connection. Connect a wire from the PC + input to the pin located on the left side of the rig behind the volume control marked "5 V". This is the internal regulated 5 volts. Trim off the old lamp wire so that it does not short out. Recheck all your work.

Turn on the rig and adjust the trimmer with your reference signal being received to obtain the same reading as you had on the old meter. Replace the cover, and that's it. Just one thought on the display. It is possible to insert ten small LEDs in place of the more expensive bar display. The appearance won't be as nice, but it's great for those on a budget.

Note: A kit of all components will be furnished for $13.75 ppd. The kit includes: MV 57164 display, LM3914, trimmer, resistors and capacitors, set of printed boards (drilled), and spacer. A set of boards can be ordered for $3.75 ppd.

Order from: MTEC WB3ATP, Box 17133, Pittsburgh PA 15235. (Pennsylvania residents add 6% sales tax.)■

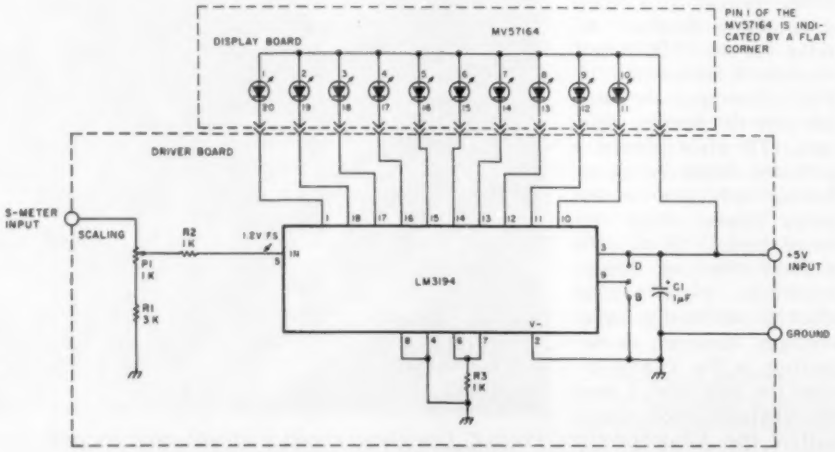

Fig. 1. Schematic of bar-graph S-meter.

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Four automatic messages and two programmable message memories (A and B) are provided. Messages A and B can be a total of 30 characters. B starts where A ends.

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For example, type your call into message A. Then by pressing the CQ button you send CQ CQ DE (message A). Press twice to send twice, etc.

The other automatic messages work the same way: CQ TEST DE (message A), DE (message A), QRZ (message A).

Special keys for KN, SK, BT, AS, AA, and AR.

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The 50 character text buffer sends smooth perfect code even if you "hunt and peck."

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You can preload a message into the buffer. Then when you are ready to transmit press the control key.

You can hold the buffer by pressing the shift key and space bar.

With the buffer in hold, you can send a comment with an external paddle as a keyer. To resume sending buffer, press the control key.

Simply backspace to delete errors.

RTTY: BAUDOT, ASCII

5 level Baudot is transmitted at 60 WPM. RTTY and CW ID are provided via message A.

Carriage return, line feed, and "LTRS" are sent automatically on the first space after 63 characters on a line. After 70 characters the function is initiated without a space. This gives unbroken words at the receiving end and frees you from sending the carriage return.

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Select alphabetic only or alphanumeric plus punctuation. Pause function lets you stop and then resume.

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Many repeaters utilize a PL™ (private line) system to permit only limited access. If a person belongs to many repeaters, the cost of frequency-determining elements for a conventional PL tone gen-

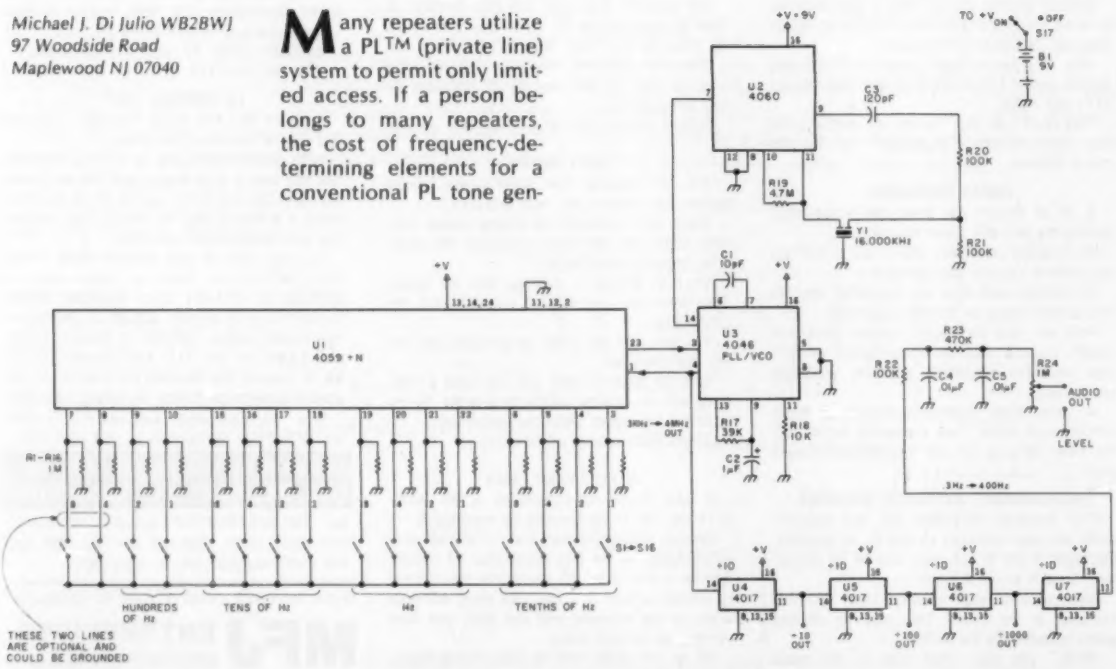

Fig. 1. Synthesized tone generator schematic.

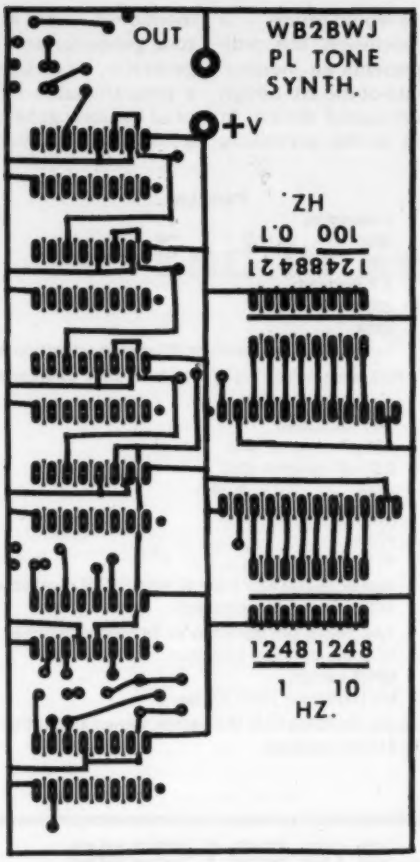

Fig. 2. PC board layout.

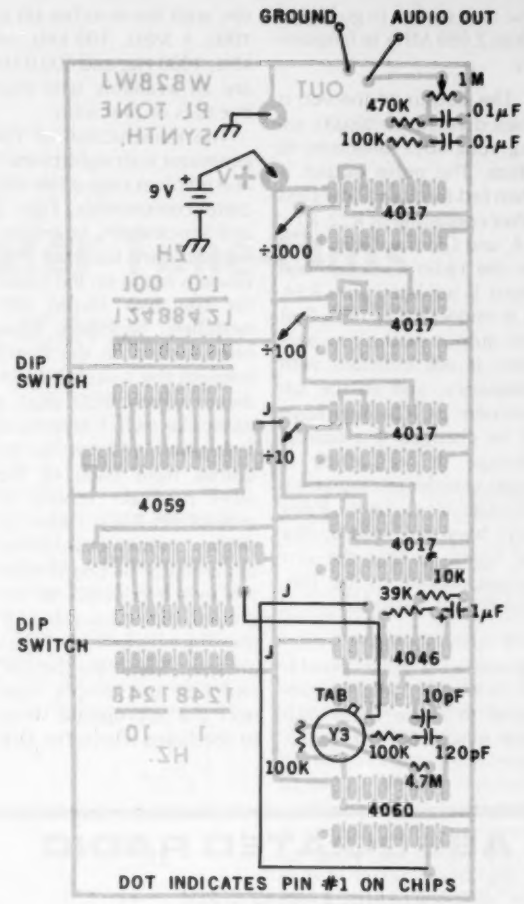

Fig. 3. Parts location.

erator can quickly get out of hand. Additionally, some clubs change their access tone periodically, and it would be convenient to have a synthesized tone generator that could be programmed using thumbwheel or DIP switches.

My design reflects the need for an inexpensive device that is easily programmed and that can generate stable tones in the frequency range of about 60 to 200 Hz. Table 1 is a listing of the common PL tone frequencies and their designators. As it happened, when I had finished my design I had a more versatile instrument that generated signals from about 4 MHz down to 0.3 Hz.

Refer to the schematic in Fig. 1. The device works as follows: The 4046 has an internal vco working in the range of about 600 kHz to 2 MHz. The 4060 is used as the reference source, starting with a 16-kHz crystal and dividing by 16 to generate a 1000-Hz reference which is fed to one input of the phase comparator of the 4046. The vco output of the 4046 goes to the input of the 4059 divide-by-n, and the output of the divider goes to the other input of the phase comparator. A phase-locked loop is thus formed, and the vco output is equal to (n)×1000 Hz, where n is the number programmed into the 4059. As the 4059 is set up, any number from 3 to 9999 can be set on the four thumbwheels or DIP switches. Therefore, the vco could potentially vary from 3000 Hz to 9.999 MHz. At 9 volts, most 4046 chips can work up to about 4 MHz. At higher voltages, frequencies up to about 6 MHz can be realized. If the device is to be used solely as a PL tone generator, S1 and S2 could be eliminated and pins 7 and 8 of the 4059 grounded, as the divide-by-n number will never go over 2000. I have included S1 and S2 in the event that

Designation	Frequency (Hz)	Designation	Frequency (Hz)
L1 or XZ	67.0	2B	118.8
WZ	69.3	3Z	123.0
LZ or XA	71.9	3A	127.3
WA	74.4	3B	131.8
L3 or XB	77.0	4Z	136.5
WB	79.7	4A	141.3
L4	82.5	4B	146.2
YA	85.4	5Z	151.4
L4A or YB	88.5	5A	156.7
ZZ	91.5	5B	162.2
L5 or ZB	94.8	6Z	167.9
1Z	100.0	6A	173.8
1A	103.5	6B	179.9
1B	107.2	7Z	186.2
2Z	110.9	7A	192.8
2A	114.8	M1	203.8

Table 1. Subaudible tones and designations.

the user wishes to go higher than 2.999 MHz in frequency.

The output of the vco is then divided by 10,000, using four 4017 divide-by-10 chips. The pulse output is then fed through a low-pass filter consisting of R22, R23, C4, and C5; the audio level to the radio's microphone input is adjusted with R24. It is important to note that the output of the low-pass filter is not constant with frequency, and so the adjustment of R24 may have to be changed if a radical change in frequency is made in order to maintain a certain deviation. Pads have been provided on the PC board so that the vco output divided by 10, 100, and 1000 is available.

If the device is configured as a pulse generator, a switch could be provided to make these outputs available. For example, with the switches set to 1000, 1 MHz, 100 kHz, 10 kHz, 1000 Hz, and 100.0 Hz are all available with four decades of precision.

The construction of the generator is straightforward and involves only a few discrete components. Figs. 2 and 3 provide PC board layout and parts location. Provision is made on the board for the two 16-pin DIP switches. Numbers have been etched on the board beneath the switches to indicate which BCD digit a particular switch selects. A 1-megohm resistor is required from each of the 4059 program inputs to ground (R1-R16). These resistors can be soldered underneath the board from the switch contacts to the ground buses provided. If the thumbwheel switches are used, eliminate the DIP switches and simply connect the appropriate wires to the holes where the DIP switches would reside.

In conclusion, this project represents an inexpensive state-of-the-art design of a very useful device. In addition to the previously mentioned uses as a PL tone generator and a pulse generator, it can be used as a programmable reference or as the tone generator for a multi-tone FSK modem. ■

Parts List

R1-R16	1 megohm
R17	39k
R18	10k
R19	4.7 megohm
R20-R22	100k
R23	470k
R24	1-megohm subminiature PC-mount potentiometer
Note: R1-R23 are 1/4-W or 1/8-W resistors, 10% tolerance	
C1	10-pF ceramic disc
C2	1-uF tantalum
C3	120-pF ceramic disc
C4,5	0.01-uF ceramic disc
U1	4059
U2	4060
U3	4046
U4-U7	4017
Y1	Statek 16.000-kHz crystal, type SX-1V (available from author for $6.00 postpaid).
S1-S16	Two 16-pin DIP switches or 16 toggle switches or four BCD thumbwheel switches
S17	SPST switch
B1	9-V transistor radio battery

PC boards are available from the author, tinned and drilled on G-10 epoxy, for $15.00 postpaid.

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When the Hong Kong Amateur Radio Transmitting Society installed our first professional 2-meter repeater recently, the transmission timer was set to two minutes. I decided that I didn't want the ignominy of timing out the repeater, so, after a little thought, I evolved a circuit which fits snugly inside the IC-211 microphone and gives me a 10-to-15-second warning before time-out occurs.

Very little modification needs to be done in the IC-211. All that is required is a 12-volt source attached to pin 3 of the microphone socket. This is obtained from J5 of the power unit.

Some modifications are necessary in the microphone plug. There are three wires and a screen braid. The screen must now be wired to provide the only ground wire for the microphone. The now spare wire is used to carry the 12-volt supply to the time-out unit.

The values of R2 and C1 may need slight adjustment to compensate for variations in voltage and capacitance. It should only be necessary to select R2 to give a time-out alert 10-15 seconds before the repeater switches off.

The green LED is mounted on the top of the hand microphone and it is very noticeable when it starts to flash its warning. ■

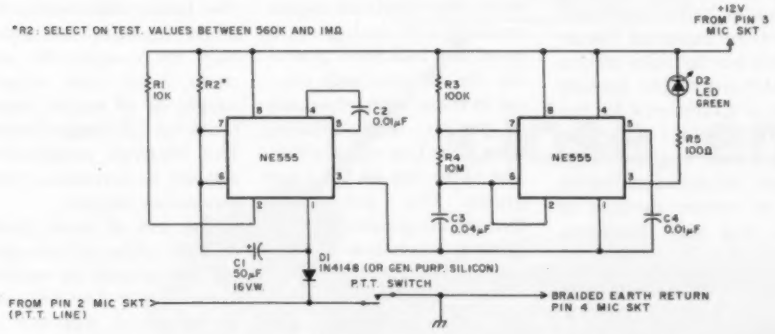

Fig. 1. Time-out circuit flashes LED after one minute, forty-five seconds.

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The History of Ham Radio

—part XII

Reprinted from QCC News, a publication of the Chicago Area Chapter of the QCWA.

The assignment to radio amateurs of the short waves below 100 meters brought about a general awakening to the value of this spectrum. In 1924, the broadcasting industry exerted great effort toward the adaptation of short wavelengths to give their programs added coverage to distant listeners by interconnecting stations across the country.

The Hoover Conference

The Hoover conference was scheduled to meet in the fall of 1924. Invitations were directed to all radio groups interested in the hearings, in which existing technical radio problems were to be explored. The assembly was to make recommendations to the Department of Commerce for important revisions of then-existing wavelength assignments, allocations, limitation of power, division of time, and such problems which relate to general reduction of station interference. Of major importance, however, was the subject of shortwave usage by broadcasters and commercial stations. The amateurs, supported by the Department, with their constant experimenting with the higher frequencies, had been providing the industry with interest in these higher-frequency ranges, demonstrating their effective capabilities. The radio law of 1912 had given the amateurs, through assignment, the use of all waves below 200 meters.

Secretary of Commerce, Herbert Hoover.

The Hoover conference was called on to revise and to somehow "make amends" to a region in the spectrum which proved to be not only large but of great future value.

The conference sessions continued from October 6 to 10, 1924. Although radio broadcasting held the center of the stage as far as the broadcasters and listeners were concerned, the radio amateur had by all odds top interest in the outcome of the deliberations. The situation, with about 600 broadcasting stations on the air, with foreign stations all over the world striving to be heard, with a wavelength revolution having set in, and with practically no worldwide rules and regulations to give direction, loomed chaotic in the radio broadcast world.

All the higher frequencies below 200 meters, formerly regarded as unsuitable for commercial purposes, were now eagerly sought as of major importance for DX transmissions. The Hoover conference was set to scrutinize these shortwave regions.

The use of spark transmission, although not ruled out completely by existing laws, nevertheless received its doomsday with the announcement at the conference that all spark should be discontinued by amateurs as well as the commercials. Spark discharges of whatever type and kind caused much of the interference encountered and should be avoided.

The conference gave the broadcasters five wavebands in the short-wavelength region for use primarily for relay broadcasting. All actions taken at the conference were recommendations to the Department, pending further outcome from future legislation.

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137—150	2,000—2,200	Point to point
120—137	2,200—2,500	Aircraft
109.2—120	2,500—2,750	Mobile
103.3—109.2	2,750—2,900	Relay broadcasting
85.6—103.3	2,900—3,500	Public service
75—85.6	3,500—4,000	Amateur (80 meters)/Army mobile
66.7—75	4,000—4,500	Public service/mobile
60—66.7	4,500—5,000	Relay broadcasting
54.5—60	5,000—5,500	Public service
51.7—54.5	5,500—5,800	Relay broadcasting
42.8—51.7	5,800—7,000	Public service
37.5—42.8	7,000—8,000	Amateur (40 meters)/Army mobile
33.3—37.5	8,000—9,000	Public service/Mobile
30—33.3	9,000—10,000	Relay broadcasting
27.8—30	10,000—10,800	Public service
25.8—27.8	10,800—11,600	Relay broadcasting
21.2—25.8	11,600—14,000	Public service
18.7—21.2	14,000—16,000	Amateur (20 meters)
16.7—18.7	16,000—18,000	Public service/Mobile
5.3—16.7	18,000—56,000	Beam transmission
4.7—5.3	56,000—64,000	Amateur (5 meters)
0—4.7	64,000—	Beam transmission

The conference concluded by listing wavelengths in effect for one year. All wavelengths from zero (0) to 3158 meters were allocated. The radio amateurs retained the previously-assigned wavebands as confirmed, with minor changes, as shown in the box.

The government departments were authorized to work in the wavebands below 150 meters "with due regard to the authorized use given to other legitimate services."

To be noted was the method of allocating wavebands. Namely, the dovetailing of assigned ranges in such a manner that the frequencies in one band were octaves of those in the preceeding band. This manner of band distribution for all services receiving assignments would, therefore, cause disturbances only to the respective assignees operating from one band to the other. Note the distribution, for instance, for the radio amateurs, all being in harmonic relation:

1.5 MHz to 2.0 MHz
3.5 MHz to 4.0 MHz
7.0 MHz to 8.0 MHz
14.0 MHz to 16.0 MHz
56.0 MHz to 64.0 MHz

Theory of Frequency Propagation: Still a Mystery?

There existed an unanswered question in the minds of most. Why are 100-meter waves able to carry across oceans at night with little power? This problem baffled the scientists and radio experimenters in the field. Dr. A. E. Kennelly of Harvard University suggested that there must be conducting layers in the upper regions making possible the transmission of radio waves. The layers most likely represented ionizing action to accomplish such results at long distances. As Professor Kennelly theorized, the greater volume activity of the higher-frequency waves enabled them to cut a sharper conducting boundary surface in the upper air than was possible for the longer waves of the lower frequency. The longer waves had a greater tendency to follow the surface of the earth, thus restricting their efficiency.

The Hoover/White Bills

The changing conditions surrounding radio, especially in the field of broadcasting, definitely necessitated comprehensive legislation by Congress. Hoover had in mind a bill in the form of emergency legislation. He thought of the White Bills which had been pending as holdovers from the previous Congress. In communication with Congressman White, his proposal was submitted in the following form to satisfy the public interest until final legislative policy could be inacted in Congress:

"Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, that it is hereby declared and re-affirmed that the ether within the limits of the United States, its territories and possessions, is the inalienable possession of the people thereof, and that the authority to regulate its use in interstate and/or foreign commerce is conferred upon the Congress of the United States by the Federal Constitution."

"That Section 1 of the act of Congress approved August 13, 1912, entitled, An Act to Regulate Radio Communication, is hereby amended by adding at the end of said section the following: The wavelength of every radio transmitting station for which a license is now required by law, its power, emitted wave, the character of its apparatus, and the time of transmission, shall be fixed by the Secretary of Commerce as in his judgment and discretion he shall deem expedient, and may be changed or modified from time to time in his discretion."

The pending White Bill was temporarily sidetracked. The National Association of Broadcasters could hardly disagree with Mr. Hoover's suggestion, so long as he was Secretary, and so long as unfair decisions could be appealed with the consent of the present Secretary.

The amateurs responded by stating that, although the bill needed amending by limiting the life term or by placing discretionary powers into the hands of some appointed radio commission to provide appeals from unfair decisions, no further suggestions would be forthcoming.

A Memorable ARRL Undertaking

The evidence of the popularity and the splendid results obtained with shortwaves in the hands of amateurs was clearly exemplified through the experiences conducted jointly with the United States Navy and the ARRL in the summer of 1925.

A shortwave station, call letters NRRL, was placed aboard the USS Seattle, flagship of the Navy fleet operating in the Pacific waters. ARRL traffic manager F. H. Schnell assembled the transmitter and receiver along customary amateur radio lines, typically breadboard but compact. Schnell was put in complete charge of the floating station, which was stashed in a small cubbyhole on the compass shack of the ship. There was no other vacant space on board. Schnell strung a single #12 wire vertical antenna up in the rigging of the ship. The Hartley circuit used operated in the 20, 40, and 80 meter bands. For a period of six months, Schnell, as sole operator, made almost daily contacts everywhere. He convinced the Navy personnel that long-range transmissions with low power could consistently outperform on short wavelengths, and had definite value over any of the long wave installations aboard ship.■

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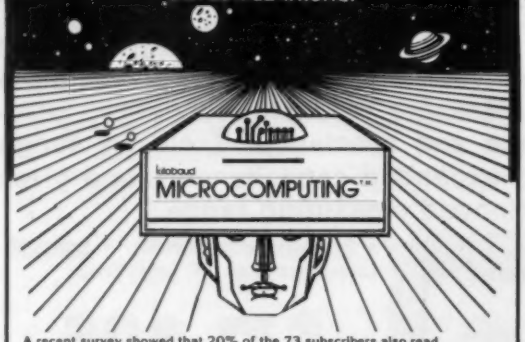

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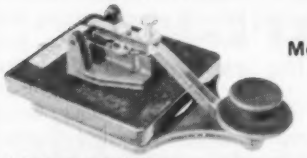

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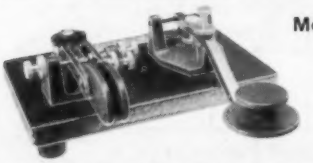

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Consider the battery charger circuit shown in Fig. 1. Two outputs are provided to charge two 6-volt, 5-Ah batteries at a time. One of these outputs can be left disconnected if only one battery needs to be charged. The two 12-volt transformers step down the line voltage to the proper battery charging voltage. Note the alternate primary connection for 220-volt operation. Diodes D1 and D2 change the ac to dc for battery charging. Resistors R1 and R2 limit current for proper fast-charging. Lamp L1 serves a dual function: It limits the current when trickle-charging and provides a visual indication that trickle-charging is occurring. The timer terminals short out the lamp for fast-charging.

Parts layout is not critical, except that R1 and R2 should have adequate room to dissipate their heat when fast-charging is used.

The batteries may be left on trickle-charge indefinitely. The timer setting should be reduced to about 4 hours when charging only one battery. Note that when the timer is timed out, the batteries are automatically placed on trickle-charge. A single battery also can be left on trickle-charge indefinitely. ■

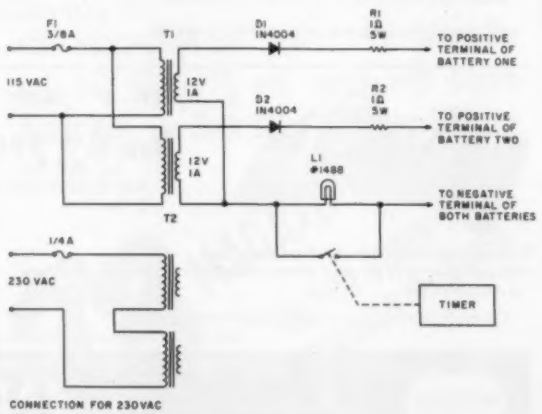

Fig. 1.

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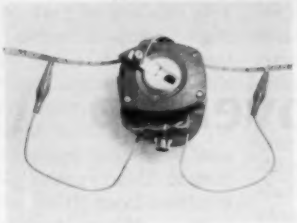

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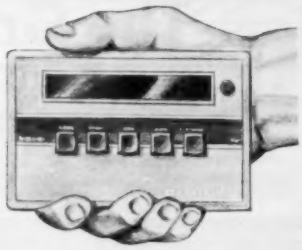

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The Great Aluminum Cover-Up

—how to paint the stuff

Editors' Note. Various potentially dangerous chemicals are used in cleaning and preparing aluminum for painting. Along with the author's suggestions, remember to provide proper ventilation of your work area and that many chemicals can damage skin and eyes. Also, acetone and lacquer thinner are highly flammable. 1-1-1 trichloroethylene may be more difficult to obtain in hobbyist quantities but is one of the non-flammable "safety solvents." Above all, if you are not sure of a chemical's risks, assume the worst. Either find out how to use them safely or don't use them!

Let's face it, aluminum is hard to paint. Sometimes we'd rather switch than fight.

Wood cabinets are great if you want the antique look, but it doesn't fit in well with the rest of your modern gear—and the shielding properties are not the best. Steel takes paint easily, but the material is hard to work with. Drilling is okay, but the stuff sure dulls a nibbling tool fast. Also, bending a fair-sized piece is more than my small brake can hack. Sheet steel is not the most readily available material for the home hobbyist, anyway. Aluminum is the ideal material to work with, if only it could be finished easier.

There is, of course, the trend toward plastic covering materials. Although dry transfers will adhere reasonably well to plastics, decals can be a problem. Also, the available textures and colors may not suit your needs.

There is the old standby of etching in a lye bath, but I get tired of all the satin aluminum panels staring me in the face, and sometimes gray stains which are not removable appear during the process. A good etch involves many of the same steps I'm going to cover below, so why not paint? The fact is, it *is* possible to paint aluminum reliably.

I began to understand the secrets of painting aluminum when I started construction of a home-built airplane. Aircraft people worship aluminum for its structural properties, so they had to learn to put on finishes that would not come right off. The primary secret of this process is that *cleanliness is next to godliness*! You will not get paint to stick to aluminum if any grease or oil is left on the surface.

There are two types of cleaning agents useful for cleaning aluminum. One is a solvent cleaner, such as acetone or trichloroethylene. The other is a detergent cleaner. Although the latter is generally a more powerful degreasing agent, it does react with aluminum and it has other problems. The more powerful detergents are quite caustic and combine chemically with aluminum. This is not always bad, but you may not want that action. Also, whereas solvents will evaporate completely from a surface, the detergent may leave a soapy residue. (You may clean off this residue with a solvent.)

As a general rule, keep the aluminum panel or piece reasonably clean as you work with it. Of course, fingerprints are inevitable, but don't plop the piece in a grease smudge when you set it down, and *never* leave a piece of aluminum sitting on a concrete floor because concrete and aluminum react strongly.

When all the drilling, cutting, and filing are done, you are ready for finishing. Clean the part in a mild detergent. Rinse thoroughly with plenty of water. Wait—don't pick up that piece! Even if you think your hands are clean, oil will appear on your skin very rapidly. From this point until the piece is primed, it must not be handled with bare fingers. Although paper towels can be used if you are careful, I recommend wearing plastic or rubber gloves.

The next step is called chemical conversion. The idea is to replace the surface layer of aluminum with some chemical to which the pain will adhere better. Although there are special mixtures sold for this purpose, they are not usually easy to come by. The easiest and cheapest way I have found is to use a product called Aluminum Jelly (although Naval Jelly also will work). This stuff is found in most hardware stores.

Brush the goop on, let it sit for a few minutes, and then rinse it off, using lots of water. You won't notice any change of appearance at this point. Next is a two-step cleaning process. Again use the mild detergent, followed again by a thorough rinse. Now, clean it with a solvent cleaner, such as lacquer thinner or trichloroethylene. Unfortunately, this immediately raises a problem. These solvents will probably dissolve your gloves! For this step you must use your bare hands, handling the aluminum part with a paper towel. Now we are ready to paint.

Aluminum must be primed with a zinc chromate primer. Don't settle for anything else. There are two kinds of zinc chromate primer. One is yellow, the other is green. The green stuff is recommended for aluminum, but unfortunately it is hard to get. The yellow kind is found in most hardware and paint stores, and will work, although it should be your second choice. Try to find the green primer at aircraft supply

stores. It is available in spray cans.

Applying the primer calls for a good spraying technique. The primer dries pretty fast, so you can give the piece a quick, light coat, wait one or two minutes, and then give it a heavy coat. This helps to prevent runs. If after the piece dries you have any runs, "orange peel," or dust in the finish, sand carefully with number 600 sandpaper. If you have to sand, remember to wear gloves, and do a follow-up by cleaning with isopropyl alcohol. This solvent will remove a reasonable amount of crud, while not dissolving the primer.

Now you are ready for painting. If spraying, I recommend that you buy the type sold for painting plastic model airplanes. There is a tremendous selection of colors available, both matte and glossy. More important, however, is the spray head. These spray cans have heads with tiny holes which give an extremely fine spray, producing a very smooth finish. After spraying, allow at least twenty-four hours for drying, especially if you are dealing with more than one color.

Next, letter the panels with dry transfers or decals. Whichever you use, they should be protected by a clear finish. So, again from the model paint counter, use either a clear matte or clear gloss spray. Be careful when spraying a clear finish, because it is very easy to put it on too thick. Use very thin coats, especially on the matte. The matte will dry in a few hours. The gloss should be put on until it first begins to look shiny, and then it should not be handled for twenty-four hours.

There, that wasn't hard, was it? It was? Yes, but aren't the results worth it? ■

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*TS-520/R-599		✓	✓				✓	✓	• 2nd IF $125		
*TS-820/R-820		✓	✓				✓	✓	for R-820 only		
HEATH	$55 EACH										
ALL HF		✓	✓				✓	✓			
DRAKE	FOR PRICES SEE NOTES										
R-4C	GUF-1 Broad 1st IF Superior Shape Factor/Ult Rej $65								✓	✓	
	GUF-2 Narrow 1st IF						✓	✓	+ pcb w sw relays $90		
	2nd IF	✓	— $65		✓	$55 —		✓	✓		
	GUD Product Detector - w pcb w relay double balanced type $30										
TR-7/R-7		✓	✓					✓			$55
COLLINS	SPECIAL $125 EACH										
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Home-Brew X-Band Wavemeter

— indispensable test gear for microwave mavens

The need to know the operating frequency of an amateur signal in the X-band assignment can be met with an adjustable cavity wavemeter and a detector. The cavity can be adjusted so that it accepts a small amount of power from the transmitter, and the detector, which is coupled loosely to the cavity, "sees" this energy and converts it to a small current that will operate a microammeter, which serves as a resonance indicator.

The wavemeter must have some sort of dial which can be calibrated in frequency. The accuracy of this calibration will depend upon many factors, such as the temperature stability of the cavity, the resettability of the adjusting system, and the exactness of the calibration reference. There are others, but these are the three which will concern us while constructing a suitable unit. The other problems will become evident as we move along.

A cavity wavemeter is a parallel resonant circuit (see Fig. 1). You have used these devices as traps in the output of your transmitters on the lower frequencies and in many other circuits of your equipment. The operation of a microwave unit isn't different from those. The Q of the circuit in which it is used and the Q of the wavemeter itself make the difference for a calibrated frequency reference. A microwave cavity such as the device we are about to construct can have a working Q of nearly 3000. The working Q will depend upon the loading of the cavity and several other factors.

An important limitation to recognize is that the device we are making will put you within the band limits, but it is not an absolute frequency meter.

A cavity wavemeter circuit diagram might look like the circuit shown in Fig. 2. A difference in the circuit when using waveguide for the transmission line will be, for example, that the coupling loop in Fig. 1 is a one-turn link to the tank coil. In the microwave configuration we will use, this is simply a small hole in the E-plane wall of the waveguide. The diameter of the hole determines how much coupling there is to the tank circuit, which, in our case, is the cavity. The diameter of the hole controls coupling and many other factors. It must be placed carefully so that the match to the transmission line will not be upset.

Now, let us examine the construction of a cavity wavemeter for X-band. (See Fig. 3.) The cavity we will construct is, in microwave parlance, a right circular cylinder cavity operating in the TE_{011} mode. It is mounted on the E-plane of an X-band waveguide, off center so that the center of the cavity will sit directly centered over a hole in the waveguide. This hole is called an iris hole. The remainder of the cavity bottom, which hangs over the waveguide, is covered with a brass half-circle soldered in place. This is shown in

Photo A. Cavity wavemeter for X-band.

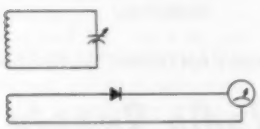

Fig. 1. Parallel resonant equivalent circuit of wavemeter.

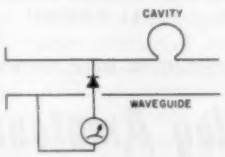

Fig. 2. Cavity wavemeter circuit diagram.

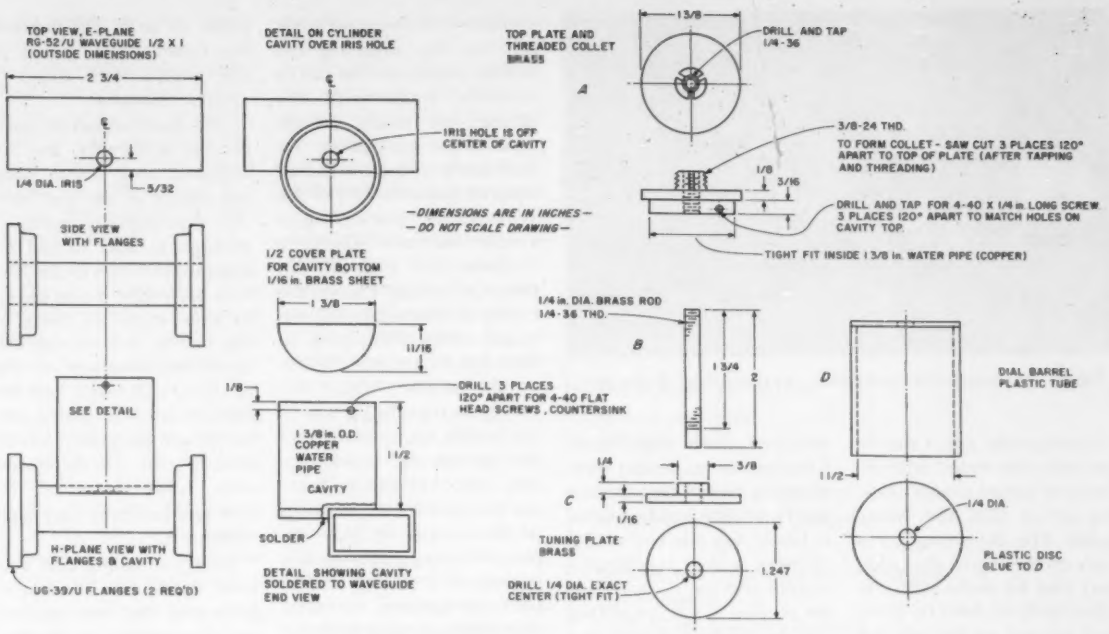

Fig. 3. Construction details for cavity wavemeter.

the photos and drawings accompanying this article.

Tuning of the cavity is accomplished by varying its length. This is done by moving a circular plate longitudinally within the cavity cylinder. A lead screw fastened to the circular plate serves as the device to move it into the cavity. The lead screw must have very fine threads, and the bushing which guides it also must have threads that fit well. A set of three cuts equally spaced around the diameter of the bushing will serve as a collet-threaded bushing when fitted with a small compression nut and lock. This particular part of the construction should be given great care since it directly affects the resettability of the wavemeter. In a commercial unit, a micrometer barrel often is used to control the circular plate motion, giving a high order of accuracy.

In the design shown, a barrel similar to a micrometer was used. It is larger, however, allowing the calibration to be inscribed more easily—and for me to read without my glasses.

The disk is constructed from a piece of flat brass at least 1/16" thick. Dimensions of the disk shown in the drawings should be followed carefully. As you will note, the dimensions allow only .03-inch spacing between the wall and the disk edge. This means that the drive mechanism must also be placed in the center of the drive holder. In each case, it is best to have your friendly machinist fabricate these pieces on a lathe. This means that the top cover, the disk, and disk holder all must be centered exactly or the disk will rub on the cavity walls.

The disk must have some absorbing material added to the back of it. This is necessary because the back of the cavity—that is behind the disk—otherwise can support resonances which wll be coupled weakly from the waveguide and will produce unwanted responses which can mislead the user. The absorbers may be constructed from a disk made of a piece of attenuator card. If you have access to powdered iron material, paper can be shaped around the periphery of the disk to make a form. Mix the powdered iron particles with some coil dope and pour in enough to make a level surface about 1/16" thick. Be sure that the surface is held level while the mix is hardening. (Powdered iron can be obtained from cup core manufacturers or, if you are really ambitious, you can make your own simply by crushing a cup core with a steel roller. Make sure that the particles are very small.) After the mix has hardened, be sure to remove all of the paper and glue from the edge of the disk.

Next, construct the waveguide section by mounting the two flanges, one on either end of the guide. This is done by cutting the waveguide ends square and then removing all burrs from them with a smooth file. Each end will have a flange soldered in place. This is done simply by sliding the flanges on each end of the guide, after first applying a small amount of soldering paste (flux) to each end. Now heat the entire assembly until the flux runs and turns the copper waveguide a deeper color. Apply just enough solder so that it will run around the joint. When this operation is completed, lap the ends of the flanges against a piece of very fine emery paper. Now inspect the joint to be sure that there are no gaps in the solder around the face of the joint.

Next, measure the distance between the rear butts of the flange, and in the center of this distance, using a square, draw a line across the E-plane of the waveguide.

On one side of the guide lying on this line, place a centerpunch mark at the distance from the outside wall shown in the mechanical assembly drawing, Fig. 3. Now drill the hole also described in this detail. Deburr this hole inside and out of the guide so that it is smooth. This is the iris

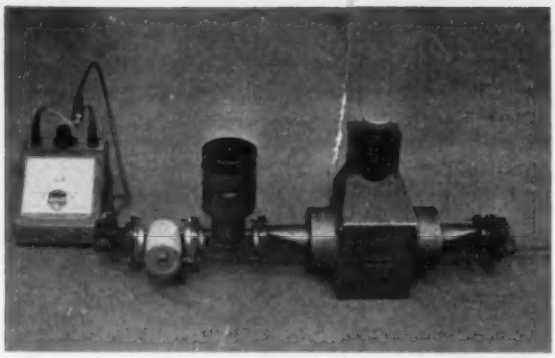

Fig. 4. Test setup for calibration, as described in the text.

coupling hole, and it should be perfectly round with no burrs or raised pieces sticking down into the waveguide. The deburring job is easy on the top of the guide and can be done with another drill bit held by hand and turned to lift off the burr. The inside of the waveguide may be done with a very small bladed knife such as an X-acto® scalpel. This can also be done from the top of the waveguide by inserting the point into the hole against the burr.

Clean a piece of copper pipe (shown in the assembly drawing) as the cavity cylinder. It should be free from all burrs on each end and polished clean with Dutch Cleanser or a similar pot-scouring compound, particularly on the inside of the cylinder. On one end of the cylinder, using a machinist's square and try, set the center so that a pair of marks can be scribed across the open face of the cylinder and on the end of its side walls.

Using flux here, too, solder the half-circle of brass in place so that it lies on the two scribe marks just made to the bottom edges of the cylinder. Now the bottom of the cavity will be half closed. Use acid-base soldering flux for this operation.

The cavity may now be mounted to the waveguide section by aligning the scribe marks on the cavity outside walls with the scribe line made on the face of the waveguide. The half circle of brass will butt against one side wall of the waveguide providing a solder surface. Using a C-clamp and a small, flat piece of wood, clamp the cavity in place, placing the wood under the clamp so that it does not mar the top of the cavity. Adjust the cavity so that it aligns with the marks on its walls and the waveguide. Make sure that the half-circle butts tightly against the side wall of the waveguide. Now apply soldering paste to the bottom of the cavity and to the waveguide surfaces that make contact with the cavity parts. Heat and solder, using just enough solder so that it will "run" when the assembly is hot enough. Let the assembly cool thoroughly before removing the clamp.

When the soldering is completed, the waveguide section should have the cavity mounted off-center on the guide with the iris hole off-center with the diameter of the cavity (see Fig. 3 details). The cavity should be in line with the scribe marks previously described as the alignment lines. If this is not the case, but the alignment marks are only a very few thousands of an inch off, do not rework to improve the alignment; this small deviation will not degrade the operation of the wavemeter too badly. Inspect the inside of the cavity where it mates with the waveguide and be sure that solder has completed the "run" around the entire cavity surface that is in contact with the waveguide.

When all soldering is complete on the waveguide and cavity body, wash off all soldering paste with very hot water. Any traces of the paste or acid will degrade the future performance of the instrument when it causes corrosion.

The most important parts of the assembly are attempted next. These parts are shown in the mechanical drawings as parts A through D and should be assembled in this order. (Before assembly, if you desire to silver-plate all parts of the cavity and waveguide, some improvement of the cavity Q will result and the performance of the wavemeter will be better. Silver-plating *can* be dispensed with, however, since the unit will perform very well without it.)

Now the tuning disk and lead screw can be assembled into the bearing and collet assembly. To do this, place a lock nut of the compression type (as found on most screwdriver-adjust locking pots) on the collet—see A in Fig. 3. The locking nut is a device which has inside tapered threads, 3/8-24, and is about 1/4-inch thick. It will compress the collet against the lead screw threads causing it to move tightly in the collet bearing. Put the nut on so that it is loose.

Now, from the opposite side of the bearing plate (A), insert the threaded end of the brass 1/4-inch rod and screw it up through the collet until about an inch of it is exposed. This item is labeled B in Fig. 3. Now install piece C, the tuning disk, on the end of the brass-threaded rod. Gently heat this piece and solder it to the threaded rod, taking care not to get solder in the fine threads. When the piece is cooled, wash off all solder paste. Now, on the back of the tuning plate, add the powdered iron as described earlier.

When the three pieces have been assembled, insert the tuning plate into the cavity and align the top plate so that the three

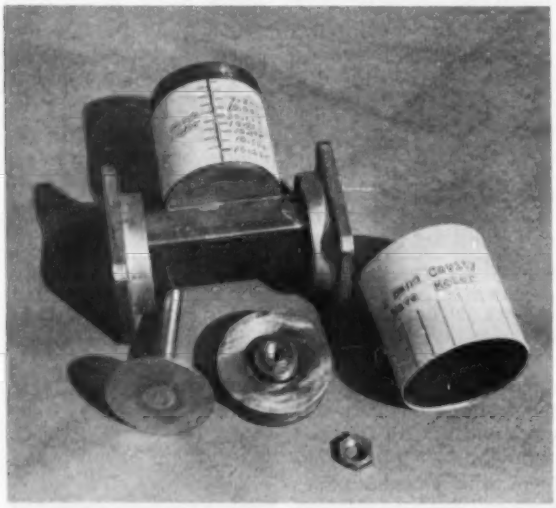

Photo B. Wavemeter parts and bottom view of the cavity, showing how it is offset from the waveguide.

screw holes in the cavity wall top mate with the three threaded holes for the three 4-40 flat-head screws, which can be found on the side of the top plate (A). Press the top plate down firmly into the cavity and install the screws to hold the plate firm.

Now screw in the tuning plate by adjusting the threaded rod; see that it moves in and out of the cavity easily, and adjust the collet lock nut so that the rod moves firmly but not hard. Now put a dab of Super Glue® on the lock nut, taking care not to get it in the cracks of the collet and on the lead screw threads. This will lock the collet lock nut in place.

Now the last piece, D, can be assembled. Simply glue the plastic disk to the top of the 1-1/2-inch diameter tube. This tube can be made from any available plastic or metal material. It fastens to the extended end of the threaded brass rod with two 1/2-36 nuts. Place one nut on the end of the rod and engage enough threads to allow about 1/4" to protrude through the assembled dial barrel (D). Then place another nut with the same threads on the rod and tighten until it is firm and the tube will not rotate. Now you have a micrometer barrel dial and a completed assembly. When rotated, it actuates the threaded lead screw and serves as a dial. It should move freely without touching the outside walls of the cavity. Cover the outside of this tube with a piece of paper. Also cover the cavity outside wall with white paper so that calibration marks can be added.

To calibrate the wavemeter you will need a signal source which can be tuned over at least the amateur assignment. Calibration points beyond the band on either end are a valuable asset and should be included. The source can be your uncalibrated X-band transmitter, a signal generator, or simply a klystron and power supply. A calibrated wavemeter and an attenuator ending in a crystal detector mounted in a waveguide adapter make up the waveguide components required for calibration. A meter to register the crystal current will serve as the reaction indicator. Fig. 4 shows how to connect these devices for calibration.

Let's assume you are using a klystron and power supply to do the job. Be sure that the klystron is oscillating in a mode that will not stop or "squeg" during the operation. Once it is oscillating, adjust the attenuator to provide a three-quarter scale reading on the current meter. Set the klystron so that it is in the range of 9.8 GHz to 12 GHz by adjusting its frequency control. Now adjust the calibrated wavemeter (which we will call the reference wavemeter from now on) until you see a pronounced dip in the output-current indicating meter. By adjusting the frequency control on the klystron and the reference wavemeter, you should be able to set up the starting calibration frequency of 9.8 GHz. When you have this frequency and you are sure of it, detune the reference wavemeter. Now tune the device you have just constructed until you get a similar reaction on the output-current meter. The dial barrel will be quite near the top of the wavemeter cavity. Now simply make a pencil or pen mark on the calibration dial paper, using the moving barrel edge as a guide for your pencil.

Continue the calibration process, setting the frequency changes in 50-MHz steps, for a start. Put the coarse calibrations on one side of the calibration line and fine steps on the other side. If you decide to make the calibration steps at a finer set of divisions after you have done a coarse calibration, do not remove the coarse steps; they can be your check points to check out how well the device resets.

The drawings showing the mechanical construction of the wavemeter are supplemented by photographs so that you can verify how the assembly goes together. It is not difficult, and most amateurs who have had experience with hand tools should be able to complete the unit satisfactorily. It is hoped that the meter will be helpful to those amateurs who want to know that they are within the X-band confines.

To use the wavemeter in your rig, simply place it in the waveguide circuit, which is the output toward the antenna, then tune it until you get a reaction in your power-output indicator, read off your frequency, and then detune the wavemeter. You may leave it in the line since it will cause very little loss to your output.

Materials for this device were obtained from Lectronic Research Labs, Inc., Atlantic and Ferry Ave., Camden, New Jersey. All of the materials for waveguide components are listed in their catalog. There are numerous other sources of material for this band and others, but this catalog should be in the hands of all microwave enthusiasts.

All letters with questions regarding this and other articles I have written will be answered if the writer includes an SASE. All telephone calls also will be answered, but please remember what your time zone is so that I don't get your call in the early hours of the morning. ■

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—add up to four I/O ports to your TRS-80

When I recently acquired a TRS-80, the first device that I wanted to interface to it was my music synthesizer (*73 Magazine*, November, 1978). It requires three output ports. Unfortunately, there is no inexpensive, commercially-available way to provide I/O for the TRS-80, but a home-brew device is easy to build and not at all expensive. A version with one input port and one output port costs about $22 (not including the unregulated power supply). Each additional port, up to a total of four of each kind, costs about $2.50.

Fig. 1 is the schematic of such a one-input/one-output device (easily expanded as described later).

The TRS-80 points to an I/O device by means of address lines A0-A7. The six more significant of these lines drive the select and enable inputs of a 74LS138 one-of-eight decoder. The Y0 output of the 138 is low whenever 1000 00XX appears on A7-A0. This output drives the enable inputs of

Photo A. Interconnect cable and top view of a wire-wrapped I/O board. The 2 × 20 header at the left accepts one end of the interconnect cable. The other end of the cable attaches to the connector at the rear of the TRS-80 keyboard unit. The 2 × 8 (output) and 2 × 9 (input) headers provide connections to the I/O ports. ICs (starting at upper left, clockwise) are a 74LS138, 74LS155, 74LS374 (output), 74LS374 (input), 74LS368, and 74LS368. Empty sockets are for additional (subsequently added) output 74LS374s. Terminal strip provides connections to unregulated power supply. LM309K regulator and tantalum capacitor are at lower right.

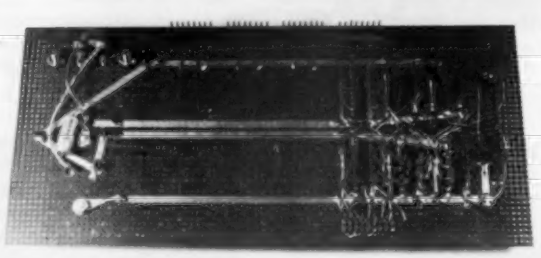

Photo B. Bottom view of the I/O board. The 2 × 20 header is at the right. The electrolytic and ceramic capacitors for the regulator circuit are at the left. Power buses are 1/8"-wide adhesive copper strips made by Circuit-Stik™. Small white spots are paint used to mark correct positions for the sockets and headers. Terminating resistors (input port) were added after the photograph was taken.

a 74LS155 dual two-line-to-four-line decoder, while address lines A0 and A1 drive the select inputs, and the $\overline{IN}$ and $\overline{OUT}$ lines each drive one of the data inputs of the 155. The $\overline{IN}$ line must be inverted since the 1C data input of the 155 is itself inverting. The net result at the outputs of the 155 is a set of four $\overline{IN}$ strobes and a set of four $\overline{OUT}$ strobes, each of which is completely decoded and which correspond to device numbers 80, 81, 82, and 83 (hexadecimal).

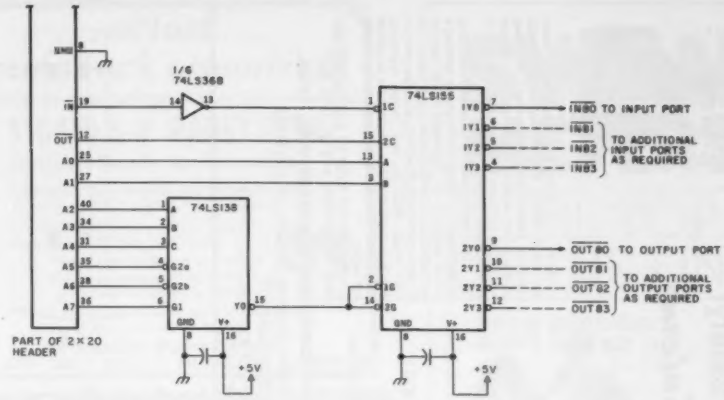

Fig. 1. Schematic of strobe generator circuit. Unmarked capacitors are 0.1-uF, 25-volt disc ceramic.

The 74LS374 is a good choice for the port functions proper. It is a positive-edge-triggered (CLK input) octal D flip-flop with tri-state outputs that are enabled via the $\overline{OC}$ input. When the 374 is used as an output port, the data lines from the TRS-80 drive its D inputs (via buffers), one of the $\overline{OUT}$ lines from the 155 drives its CLK input, and its $\overline{OC}$ input is tied to ground. Note that data from the 74LS368 buffers is inverted. Using 74LS367 buffers avoids this since they are non-inverting, but at the expense of an extra IC to provide the inverter for the $\overline{IN}$ line.

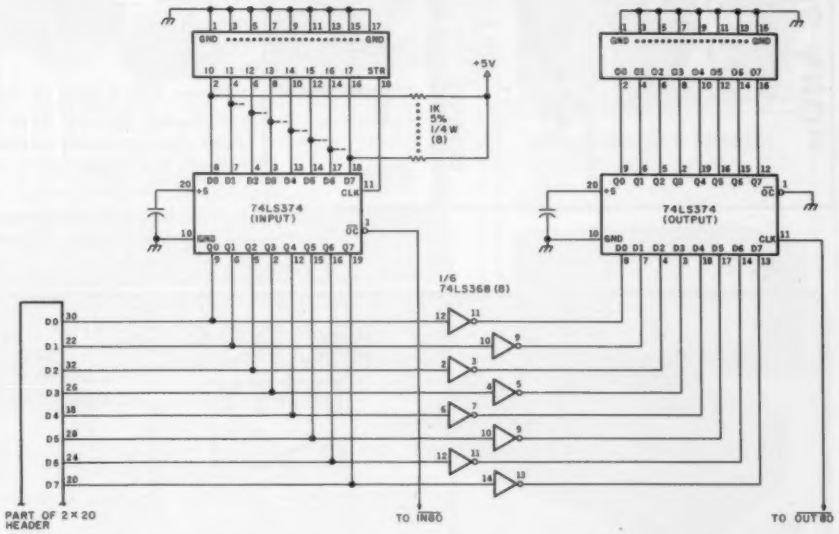

Fig. 2. Schematic of port function circuit. Unmarked capacitors are 0.1-uF, 25-volt disc ceramic. Tie enable inputs (pins 1 and 15), unused data inputs (pins 2, 4, and 6), and ground pin (8) of the 74LS368s to ground. Tie +5-volt pin (16) of each 74LS368 to +5 volts and bypass to ground via a 0.1-uF, 25-volt disc ceramic capacitor.

Adding another output port simply involves connecting another 374 to the buffer outputs and using one of the remaining $\overline{OUT}$ strobes to drive its CLK input.

When the 374 is used as an input port, its outputs drive the data lines to the TRS-80 and one of the $\overline{IN}$ strobes from the 155 drives the $\overline{OC}$ input of the 374. The clock and data inputs of the 374 provide the port function. Substituting a 74LS373 for the 374 provides a tracking (rather than clocked) input. The outputs of the 373 track its inputs as long as its CLK input is held low.

Adding another input port simply involves connecting another 374 (or 373) to the data lines and using one of the remaining IN strobes to drive its $\overline{OC}$ input.

Photo A shows the connector cable and the top of a wire-wrapped I/O board which provides one input port and four output ports. The connector cable shown is made of junk-box parts. An AP Products 924005-6R socket/jumper (Jameco Electronics) and an AMP 88103-1 card edge connector (several sources) provide an easily-obtained alternative. The card edge connector mates with the PC fingers on the TRS-80 keyboard unit, while the socket/jumper connects to the 2 × 20 header on the

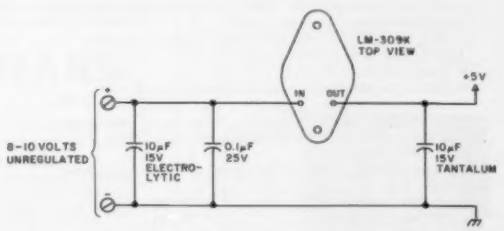

Fig. 3. Schematic of power-supply regulator. The 10-uF capacitors are tantalum and electrolytic; the 0.1-uF capacitor is disc ceramic.

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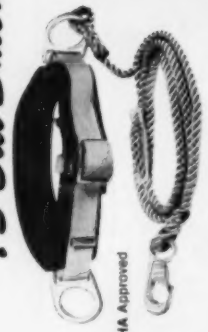

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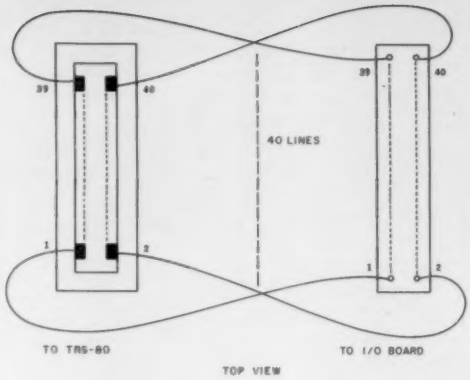
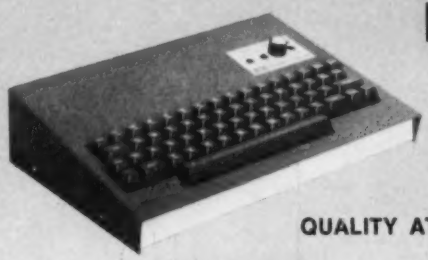


Fig. 4. Schematic of interface connector. Viewed from the rear of the TRS-80, pin 1 is the upper-left finger and pin 40 is the lower-right finger on the PC board.

I/O board. The connection to each port is via a 2 × 8 (output) or 2 × 9 (input) header.

Photo B is a shot of the bottom of the I/O board taken during construction. It shows the copper-foil bus strips which carry power to the ICs, but not the 1k terminating resistors which were added later.

Building the board required only three evenings, including one just to set up the epoxy which holds the sockets and headers to the perfboard. In operation, the board has been glitch-free. For the time and money involved, it can't be beaten. ■



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Practical Af and Rf Speech Processing

—using modern ICs

The value of speech processing at either the af or rf levels for SSB transmitters has certainly been discussed and presented in many forms. However, some readily available and inexpensive ICs well suited to speech processing applications are still overlooked by many amateurs. These are the English line of Plessey ICs which are distributed also in the U.S.

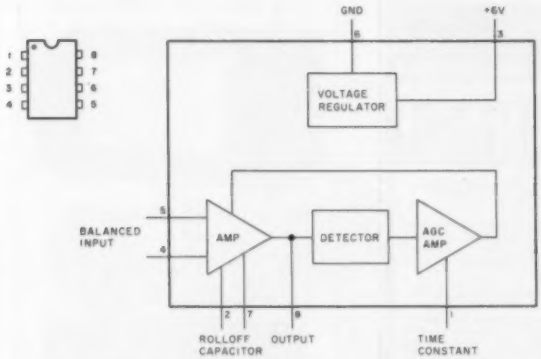

Fig. 1. Internal stages in the Plessey SL1626C af compressor.

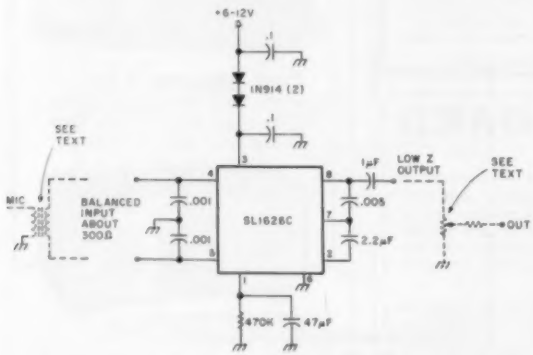

Fig. 2. Complete circuit of the af compressor with optional input transformer and output-level control. If the circuit is powered by a 9-volt transistor radio battery, the battery should be bypassed with a 100-uF, 15-volt capacitor.

Perhaps the most interesting IC yet developed for use in an af speech compressor is the Plessey SL1626C. A block diagram of the small, eight-pin IC is shown in Fig. 1. The input stage is a balanced one with a low-impedance input of about 300 Ohms. Part of the output (low impedance at about 50 Ohms) drives a detector stage which, in turn, drives an agc stage which regulates the gain of the input amplifier. A very wide control range of 60 dB can be achieved (100-uV to 100-mV input) over which the output will remain essentially constant. By the use of a small transistor-type matching transformer at the input, almost any low- or high-impedance microphone can be used with the IC. Supply voltages between 6 and 12 volts can be used with the unit, drawing about 14 mA at 6 V.

A few simple external components are all that are needed to implement a practical circuit. The low-frequency rolloff response of the compressor is set by a capacitor connected between pins 2 and 7. A 3-dB point at about 100 Hz is achieved by using a 2.2-uF capacitor, for example, although the value can be adjusted as desired for higher frequency rolloffs by reducing the size of the capacitor. The high-frequency rolloff response depends on the value of a capacitor connected between pins 7 and 8. A .005-uF capacitor provides a 3-dB point at 3 kHz, but one can vary this capacitor value also to achieve the best speech response with a given microphone.

The agc time constant is set by a parallel resistor/capacitor combination connected from pin 1 to ground. The attack time is set by the capacitor at 0.4 milliseconds/microfarad. The decay time constant is set by the time constant of the combined resistor/capacitor combination. The resistor and capacitor values can be varied to suit individual preferences, but the manufacturer recommends that the resistor value be between 500k and 1.5 megohms and that the capacitor be not less than 22 uF.

A practical circuit using the SL1626C is shown in Fig. 2. In addition to the resistor/capacitors mentioned previously, several other capacitors are used for rf bypassing. A balanced input is shown, although a

single-ended input can be used at the sacrifice of some of the control range. In general, it is better to use a small input transformer of the transistor-interstage type. These transformers are inexpensive, and a 500/50k-Ohm type will suffice for most high-impedance microphones, while a 500/10k-Ohm type can be used with medium-impedance microphones.

There are no adjustments to make and the circuit will work very well in most applications with the component values shown. The one exception might be in a mobile application where the large dynamic range of the circuit might cause excessive background noise pickup during speech pauses. This problem can be cured by also placing a resistor between pins 7 and 8 to reduce the dynamic range. Resistor values of about 500 to 1,000 Ohms should be used, reducing the dynamic range to 35-40 dB. A 1k potentiometer may be connected on the output if it is desired to have a variable-output control. A series resistor may also be placed in the output line, if necessary, to reduce loading on the stage that the compressor works into. For instance, if the output of the compressor goes to a high-impedance microphone input on a transceiver, a series resistor of 50k to 100k may be necessary.

A parts layout for the SL1626 circuit is shown in Fig. 3. While there is nothing critical about the wiring of the circuit, a good, compact layout with good grounding will contribute greatly to avoiding any rf feedback problems from this high-gain circuit. Single- or double-sided PC board construction or use of the isolated-pad technique are particularly recommended. There are so few interconnections involved that isolated-pad construction is just as fast as etching a board, and this technique leaves almost all of the copper on the board for a good ground plane.

For those not familiar with the technique, it just involves the use of a special drill that simultaneously drills a hole in the PC board for a component lead while removing a small ring of copper around the hole for a small radius so that one can interconnect component leads without shorting to the remaining copper. The same effect can be achieved using regular drills—a small one for the component lead hole and a larger one to cut the copper away around the hole. A small modeling knife is handy in removing the copper so that there are wiring channels, where necessary, between component holes. I have used this technique for dozens of small projects with good success. It has all the electrical advantages of an etched board with almost the ease of construction associated with plain perforated board stock.

The af speech-compressor circuit just described is easy to implement and does provide some added audio "punch" with almost all transceivers. Probably, on the basis of the investment necessary in terms of money and constructional complexity, it provides the best return in terms of increasing a transceiver's effectiveness. However, numerous tests have shown that clipping at the rf level is still more effective. Completely outboard devices can be constructed to obtain the benefits of rf clipping where an SSB signal is generated, clipped, filtered, and then demodulated to provide an audio signal to a transceiver. The most economical way to provide the benefits of rf clipping, however, is to break the SSB generation chain in a transceiver, as shown in Fig. 4, and insert a few additional stages for clipping, amplification, and filtering. Some of the Plessey ICs make this particularly easy to do.

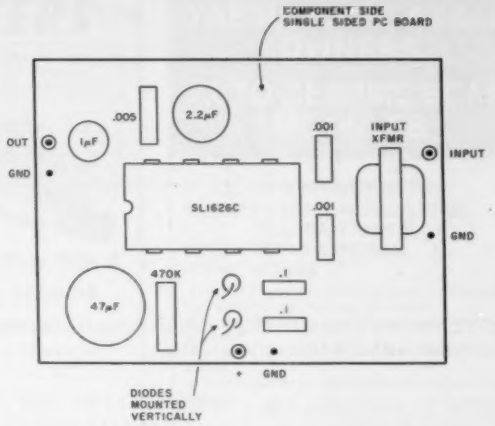

Fig. 3. A typical parts layout for the af compressor. The layout is exaggerated, of course, but any similar layout where the input/output is kept well separated will suffice.

The Plessey SL610C is an integrated rf amplifier having a modest voltage gain and a bandwidth up to 140 MHz. The supply voltage can be 6-9 volts, and the current drawn is about 15 mA. Internal HF decoupling is provided and the external circuitry needed is very simple. In fact, if agc is not applied to a stage using the SL610C, there is no need for any external circuitry other than an input/output coupling capacitor or a tuned circuit, if desired.

The Plessey SL613C is a broadband limiting amplifier consisting of a two-transistor amplifier stage, the output of which drives an emitter-follower output stage. Negative feedback is incorporated and careful design of the bias and feedback circuitry ensures that the amplifier limits or clips symmetrically. The limiting action starts with about a 120-mV input. The amplifier, like the SL610C, has internal HF decoupling so that the external circuitry needed is simplified. The circuit can operate on 6-9 volts and draws about 15 mA.

The two ICs just described can be used to form a simple but very effective rf signal processor (clipper) as shown in Fig. 5. This circuit, of course, is meant to be used in the scheme shown in Fig. 4. It can be

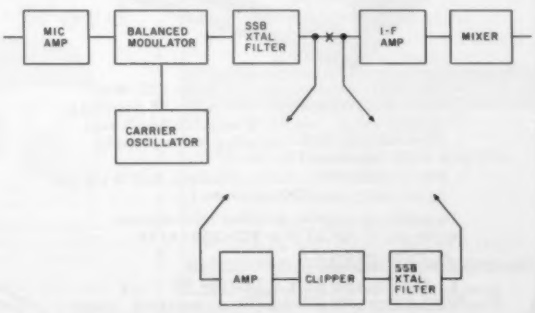

Fig. 4. Rf clipping can be added to most SSB transceivers by breaking the i-f chain after the SSB filter and adding the stages shown.

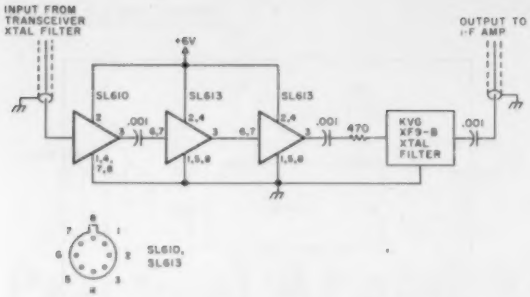

Fig. 5. Extremely simple but high-performance rf-clipper circuit shown with a 9-MHz crystal filter.

adapted to practically any transceiver i-f, although the circuit as shown uses a sideband filter for a typical 9-MHz i-f where the upper-sideband crystal frequency would be 8998.5 kHz, and the lower sideband crystal frequency would be 9001.5 kHz.

The KVG crystal filter shown is a West Germany product distributed by Spectrum International, Box 87, Topsfield MA 01983. It can be used with many 9-MHz i-f transceivers although, if possible, the best thing to do is to purchase a duplicate of the sideband filter used in any given transceiver.

The circuit, as can be seen, is extremely simple. The input signal is amplified by the SL610C stage and fed to two cascaded SL613Cs. The latter two stages clip the signal but, because of their inherent symmetrical clipping, preserve the zero-crossing points. The harmonics and higher-order intermodulation products are removed by the following crystal filter.

The mean-to-peak ratio of an unprocessed SSB signal can be increased by up to 12 dB. Although it is exactly this increase that makes rf speech processing so effective, you have to be sure that the output stage and power supply in a transceiver can take the extra average power dissipation. There is no way to be absolutely sure of this beforehand although, if the SSB and CW power-input ratings of a transceiver are drastically different (the CW input being lower), you should proceed with caution. This is not true of most newer transceivers, but mainly of some older types using sweep-tube finals.

The circuitry of Fig. 5 can be assembled on a small PC board. Again, the isolated-pad type of construction is recommended since there are so few interconnections and components involved. Short lengths of coaxial cable are used to connect the input/output into the transceiver circuitry, and a small DPDT relay can be incorporated to provide the ability to switch the clipper in or out of the transceiver circuitry. If you are wondering why there are no bypass capacitors, etc., remember that HF decoupling networks are *internal* to each IC.

The Plessey units are distributed nationwide; I have purchased units from Ancroma Corp., PO Box 2208, Culver City CA 90230. However, if you cannot locate a source of supply, write directly to Plessey, 1641 Kaiser Ave., Irvine CA 92714, for the name of the nearest distributor. ■

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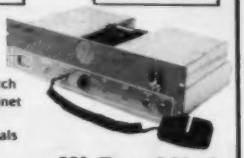

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The circuit was ready to try out after only a few minutes at the breadboard. I cut, drilled, and bent 90 degrees a thin aluminum bracket to hold the phototransistor in front of the channel light. The microphone plug nut held the bracket to the panel. A piece of ¼-inch black plastic tube shielded the phototransistor from stray light.

I then got the idea of using the relay to key a second transmitter on another channel to make a repeater. An audio output transformer matched the four Ohms from the Yaesu's audio out jack to the microphone input of the second unit. The timer could now be adjusted to control the length of the squelch tail.

Several of these LORs have been built, all with good results. Layout is not critical: Printed circuit board, breadboard, chassis, or "dead-bug" construction all work well. Dead-bug is when the IC or transistor is fixed to the board with its legs pointing up. The .001-uF capacitors suppress any false triggering due to stray rf. The only caution is to use a good quality timer capacitor for C1. Most electrolytic capacitors differ a lot from the value on the label. Try several.

Do not forget the diode on pin 3 of the NE555; otherwise, the relay may latch.

Adjust the time by R1 to suit your needs. The sensitivity must be adjusted to a minimum working position to prevent false triggering by stray light.■

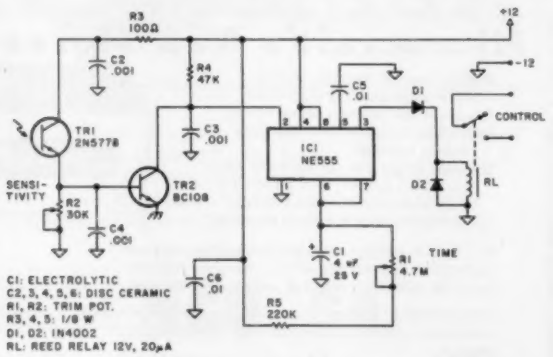

Fig. 1.

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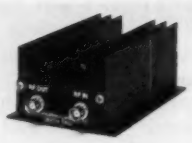

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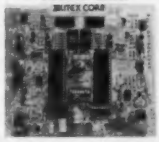

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The Calibrator Gater

—so you can find yourself

Ever had trouble picking your calibrator signal out of the heterodynes and QRM on the HF bands? Does your calibrator poop out on 15 and 10? How about giving it a little personality to make it stand out? This circuit does just that. It switches your calibrator signal on and off rapidly, giving it a distinctive sound that is easy to find in even the thickest of crud. It is simple, cheap (about $3 with all-new parts), easy to install on just about any receiver or transceiver, and leaves no irreversible modifications. About the only thing it ain't is original; Ten-Tec has had a similar feature on its Triton models for some time. However, if you don't own a Triton, why not give this circuit a shot?

The circuit, in keeping with personal tradition, is simple. It consists of a CMOS quad gate connected as a low-frequency oscillator which drives a CMOS quad bilateral switch. This switch is connected between the calibrator output and the antenna input to the receiver and serves to pulse the calibrator signal rapidly, making it sound different from most other racket present on the band. Since CMOS circuits work satisfactorily over a 3-to-15-V dc range of supply voltages, locating a suitable power tap-off point in the rig shouldn't be much of a problem. On tube-type rigs, the half-wave rectifier and filter capacitor shown will allow the circuit to be operated from an ac tube filament or pilot-light wire. Most transistor and hybrid rigs already have a suitable dc supply built in. That's why the rectifier is shown separate (but still included in the $3 price tag). Use it if you need it.

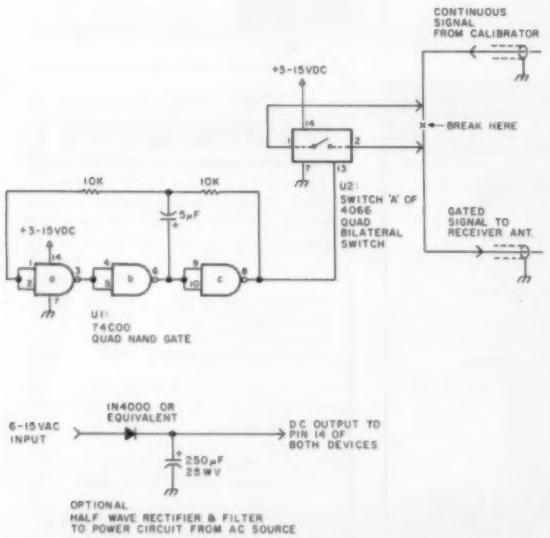

Fig. 1. The Calibrator Gater.

Construction is non-critical. Both CMOS devices are static-protected, so unless you barbecue them with a 150-Watt radiator-shop special, the circuit should work no matter how much you torture it. Use a short piece of wire between the circuit and the calibrator and again between the circuit and the receiver antenna input, or else use miniature coax to prevent any instability or stray coupling caused by the modification.

On my HW-101, the device was built on a 1" by 1½" piece of perfboard and allowed to hang by its wires under the bandpass circuit board. Connections consisted of merely unsoldering the center conductor of the coax (antenna input) leaving the bandpass board right after CR201 (calibrator output) and connecting one wire of the CMOS switch to the coax and the other wire to the spot where the coax had been on the board. Ac power was taken from pin 4 of tube V19 and was rectified by the circuit shown. Incidentally, it doesn't matter which wire of the CMOS switch goes to the calibrator or antenna input; it works just fine either way.

Most calibrators don't run continuously, only when they are needed. Thus, unless you have an oddball, no power switch is needed for the circuit. Current consumption is negligible, even for the QRP fan. With the calibrator turned off, the switching action of the device is unnoticeable under normal conditions. However, at full rf and af gain with no antenna connected, a distinct clicking sound is detectable. If this should become noticeable

with an antenna connected, a switch for the circuit will have to be added (not included in the $3 price tag, since anyone with a receiver or location *that* quiet doesn't deserve to pay less than $3).

According to the *CMOS Databook*,[1] the 4066 quad bilateral switch is capable of passing signals up to 40 MHz with little attenuation, so that takes care of all calibrator harmonics for the HF bands. Due to the conservative nature of many CMOS specifications, it is very possible that the circuit would work at six meters, or even two meters with a simple preamp after the switch, although that's just speculation.

So I conclude this article with a couple of thoughts for the experimenter. First, if the frequency at which the calibrator is gated doesn't suit you, here's the formula to change it:[2] Frequency (in Hz) desired $= 0.599/(R \times C)$, R being in Ohms and C being in farads (multiply microfarads by 1,000,000 to get farads). Note that R is either resistor, as long as both are equal.

Also, since only one of the four bilateral switches is used in this project, why not leave some provision for using the other three? They're dandy for switching in audio or CW filters, speech processors, extra phone-patch or microphone inputs, various metering modifications, or for just about any low-level audio or rf application where the signal voltage doesn't exceed the voltage on pin 7 of the 4066. ■

References

1. *CMOS Databook*, National Semiconductor (Radio Shack printing), page 2-150.
2. *CMOS Databook*, application note by Mike Watts, National Semiconductor, page 5-22.

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Reader Service—see page 130

Paul Kalkstein N1PL
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The Flexi-Plane Antenna

—this "scrawny ducky" will boost your HT's signal

On the lower Kennebec River near Bath, Maine, the XYL of N1PL talks through the Streaked Mountain repeater (.28/.88), some 70 miles away from the floating QTH.

Do you have a 2-meter handie-talkie? Where and when do you use it? If you're like me, you probably find yourself with unit in hand in a variety of circumstances. You may be chatting across a hamfest on .52, trying to make a distant repeater from a mountainous site you have arduously attained, or coordinating a civil-defense drill. What do you use for an antenna?

The Rubber Duck

For general toting and flea-market work, the flexible rubber ducky makes a fine antenna. It is shorter than a quarter wave and will not break off if you should accidentally sit down with the little rig in your back pocket. But with flexibility comes a drawback: The wobbly ducky just doesn't put out the juice. A friend told me that the rubber ducky was down 6 dB—but he didn't say down from what.

My own measurements, using a home-brew field-strength meter calibrated at 146 MHz (by comparing readings to those at several power levels from my Sigma RF-2000 power meter), suggest that the signal from the rubber ducky is down more than 3 dB compared to the signal from a ground plane. Field-strength measurements were taken at 20 meters (65.5 feet), or roughly 10 wavelengths.

That 3 dB difference (or more—measurements were conservative) means losing *half* of your transmitting signal strength, and also *half* of the strength of the signals you receive. Not so good. Do you want to stick to that rubber ducky?

What Alternative?

Surely, you won't want the ducky for mountaintopping. You might as well use a small beam there, since you're already going to the trouble of hauling your body up. However, I find that much of my handie-

talkie use is of the mid-range variety. I am often 20 to 60 miles from a repeater and, depending on repeater coverage, access is marginal with the rubber ducky.

What I did was build an antenna which combined the advantage of the rubber ducky (flexibility) with the relative gain of the ground plane. The Flexi-Plane is actually more flexible than the duck—and a good sight cheaper!

I made mine for the cost of a connector. I also used some copper wire that I had in the shack. (Don't use aluminum, because it's brittle and won't solder.)

How To Build It

Like any ground plane, the Flexi-Plane consists of a quarter-wave radiator and an artificial ground plane of quarter-wave radials. I made the radiator of #18 copper bus wire cut to a length of 0.49 meters (19.3 inches). For the radials, I used two lengths of #22 solid copper hookup wire about one meter (39 inches) long.

I put the end of the center radiator through a short piece of insulation stripped from a bit of zip cord. Then I pushed the wire and insulation down into the center of the BNC connector, soldered the wire to the small pointed tip, and, to hold things in place, poured some plastic rubber into the top of the connector.

Next, I stripped some insulation from the center of the hookup wire radials, wrapped each wire around the connector, and soldered them in two places. Thus I had four radials, each about 0.49 meters long. Of course, a connector other than a BNC might require a slightly different procedure.

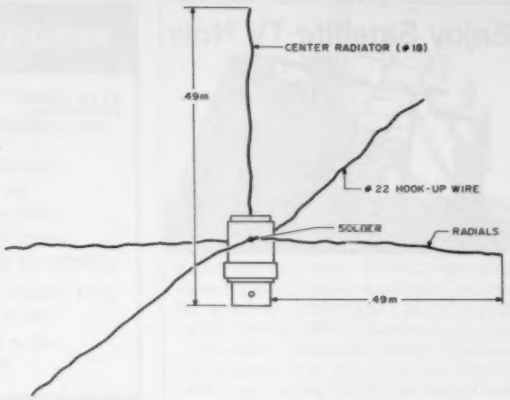

Fig. 1. The Flexi-Plane with BNC connector.

Not Pretty, But Beautiful!

The resulting antenna isn't handsome. But it is highly flexible. You can roll it into a ball or roll it around the rig. (When you unroll it, the elements don't have to be arrow-straight, so don't worry!) In three years, my Flexi-Plane has been all over the country and has spent many hours in my boat in Maine with no deterioration.

Best of all, it combines what all hams strive for in an antenna, the ability to produce a strong signal, with what my brother, Koof W3KF, finds especially beautiful in a home-brewed item—cheapness! ■

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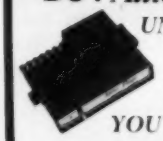

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CB to 10. . . and Beyond

—getting excited at 432

Shortly before the January VHF contest, a commercial 432-MHz transverter was purchased as a last minute attempt to add another potential source of points to the station. However, the station's only HF transceiver was already providing the necessary 28-MHz drive for a pair of 6- and 2-meter transverters. In order to provide for independent operation and monitoring on 432, another 10-meter transceiver would be required (preferably solid state in keeping with the rest of the station).

After purchasing one tower, several transverters, a truck load of aluminum for antennas, and miscellaneous other items, to bring home another "radio" would have meant instant divorce court and possible damage to the operator! Enter—one solid-state, 23-channel, SSB, neglected CB rig, vintage 1973.

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2. Addition of one inductor in the clarifier circuit to provide for continuous coverage.
3. Retuning the rig for 28-MHz operation.

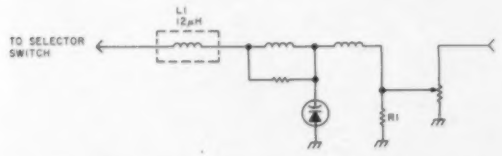

Fig. 1. SBE-12CB clarifier circuit. L1 is added to extend range to 15 kHz. R1 is 1-4k Ohms and controls linearity. All other components are existing.

The SBE-12CB uses three oscillators and a total of eleven crystals to synthesize its 23 channelized frequencies. A fixed 7.8-MHz oscillator is controlled by a single 7.8025 crystal. This oscillator remains unchanged. The other two oscillators, 7 MHz and 11 MHz, are controlled by four and six crystals respectively. The channel selector switch selects one (out of 4) crystals from the 7-MHz oscillators and one (out of 6) crystals from the 11-MHz oscillator.

For LSB and AM conversion, the selected outputs of the 11-MHz and 7-MHz oscillators are added to produce a signal around 19 MHz. Adding the fixed output of the 7.8-MHz oscillator produces the required frequency. For USB conversion, this same 19-MHz signal is added to the sec-

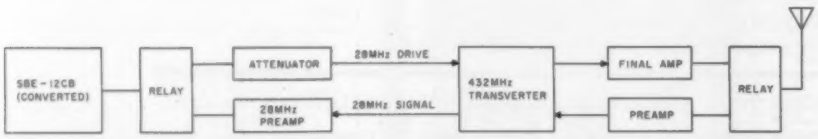

Fig. 2. CB to 432.

Channel	Center Freq. Before Conversion	11-MHz osc. Xtal Freq. (Unchanged)	7-MHz osc. Xtal Freq.[1,2] (Before Conversion)	Center Freq. After Conversion[1] 10 Meters, CW	Center Freq. After Conversion[2] 10 Meters, Phone
1	26.965	X6 = 11.700	X2 = 7.4625	28.0050	28.5050
2	.975		X3 = 7.4725	.0175	.5175
3	.985		X4 = 7.4825	.0300	.5300
4	27.005		X5 = 7.5025	.0425	.5425
5	27.015	X7 = 11.750	X2	.0550	.5500
6	.025		X3	.0675	.5675
7	.035		X4	.0800	.5800
8	.055		X5	.0925	.5925
9	.065	X8 = 11.800	X2	.1050	.6050
10	.075		X3	.1175	.6175
11	.085		X4	.1300	.6300
12	.105		X5	.1425	.6425
13	.115	X9 = 11.850	X2	.1550	.6550
14	.125		X3	.1675	.6675
15	.135		X4	.1800	.6800
16	.155		X5	.1925	.6925
17	.165	X10 = 11.900	X2	.2050	.7050
18	.175		X3	.2175	.7175
19	.185		X4	.2300	.7300
20	.205		X5	.2425	.7425
21	.215	X11 = 11.950	X2	.2550	.7550
22	.225		X3	.2675	.7675
23	.255		X5	.2925	.7925

Notes:

1. 7.8-MHz osc. xtal freq. = 7.8025 MHz
   (CB and 10 meters)
   11 MHz osc. xtal freq. = 11.700 MHz = X6
   (CB and 10 meters) 11.750 MHz = X7
   11.800 MHz = X8
   11.850 MHz = X9
   11.900 MHz = X10
   11.950 MHz = X11

2. 7-MHz osc. xtal freq. =	CB	10 meters, CW	10 meters, phone	
	7.4625 MHz	8.5025	9.0025	= X2
	7.4725 MHz	8.5150	9.0150	= X3
	7.4825 MHz	8.5275	9.0275	= X4
	7.5025 MHz	8.5400	9.0400	= X5

Table 1. SBE-12CB synthesizer mixing scheme.

ond harmonic from the fixed 7.8-MHz oscillator (15 MHz) to produce a signal in the 34-MHz area. Subtracting the output of the 7.8-MHz oscillator from this sum yields the required USB frequency. Table 1 summarizes the synthesizer.

The first column of Table 1 indicates the frequencies available from this rig for CB operation. All that is required to shift these frequencies into the 10-meter band is either to replace the six 11-MHz crystals or the four 7-MHz crystals. Since four is cheaper than six, the 7-MHz oscillator was attacked. The new crystal values are determined by taking the new center frequency, subtracting the existing center frequency, and adding this difference to the value of the existing 7-MHz crystals.

Example: The new desired channel 1 frequency is 28.005 MHz and the old frequency is 26.965; the difference is 1.040 MHz.

The current 7-MHz crystal is 7.4625 MHz; add the difference (1.0400), and the new crystal required is 8.5025 MHz = X2.

Since there is a greater jump between channels 3 and 4 for CB operation, the last 7-MHz crystal (X5) is .02 MHz greater than X4. X4, X3, and X2 are each 0.01 MHz apart. In order to provide for continuous coverage and more linear coverage, the new crystals were placed .0125 MHz apart in frequency. This reduces the final frequency coverage only slightly (2.5 kHz) and allows for continuous tuning, which was deemed a reasonable sacrifice.

Table 1 indicates the new crystals required for operation at 28 to 28.3 MHz, and also those required to operate in the phone portion of the 10-meter band (28.5-28.8 MHz). The actual coverage in each case is about 300 kHz.

The varactor clarifier of the SBE-12CB tunes ± 700 Hz from the selected center frequency. In order to provide for continuous coverage, a spread of about 15 kHz is required. Fig.1 shows the existing clarifier circuit in the unit plus the additional 12-uH molded choke (L1) which was added to extend the range to the required 15 kHz. Adding the choke caused the tuning range of the clarifier to vary in a nonlinear fashion, and it was found that R1 could be changed to rectify this situation. The new value of R1 is determined best by experiment and seems to fall in the range of 1 to 4k, depending upon the spread finally selected.

This completes the conversion. Retuning this rig is simple if you have the SBE service manual or *Sams Photofacts®* #CB-50 (described 1973).

The rest of the setup for 432 is simple enough. An attenuator was built to hold down the 12-Watt output of the CB rig on sideband to that required by the transverter. No preamp was deemed necessary for the SBE-12CB, but a 432-MHz one was utilized (see Fig. 2).

There is nothing unique about the 432-MHz utilization of this rig, but the conversion is an interesting project which can yield a low-cost, 10-meter mobile rig.■

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Three-Way Power Supply

—ideal for CMOS, TTL, op-amp projects

For as long as I can remember I have wanted an inexpensive, self-contained positive and negative variable-voltage power supply for experimenting with transistors, digital, and linear integrated circuits. When National Semiconductor introduced their LM317 and LM337 adjustable regulators, I felt that this was the answer to my prayers. The LM317 and LM337 are the commercial-grade versions of the LM117 and LM137, which are positive and negative adjustable 3-terminal voltage regulators respectively, capable of supplying an excess of 1.5 Amps over a 1.2- to 37-volt output range. These two devices are easy to use, requiring only two external resistors to set the output voltage. They both also feature internal current limiting, thermal shutdown, and safe-area compensation, making them virtually blow-out proof against overloads.

This article describes the construction of a self-contained variable positive and negative regulated voltage power supply with an additional 5-volt supply for TTL integrated circuits, giving the final specs shown in Table 1.

The Circuit

As shown in Fig. 1, the power supply uses three integrated circuit voltage regulators: LM309, LM317, and LM337. The necessary positive and negative supply voltages are derived from the grounded center-tapped 25.2-volt transformer secondary and a full-wave rectifier bridge. After rectification, the positive voltage is filtered by C_1 while the negative voltage is filtered by C_4. For the positive supply, the output voltage is set by the 270 Ω resistor R_1 and the 5k Ω potentiometer. To improve ripple rejection, a 10-μF aluminum electrolytic capacitor C_2 is added across the 5k Ω pot. C_3 is added to improve the regulator's transient response. Diode D_5 protects the LM317 in case the output is shorted to ground. In a similar manner, the nega-

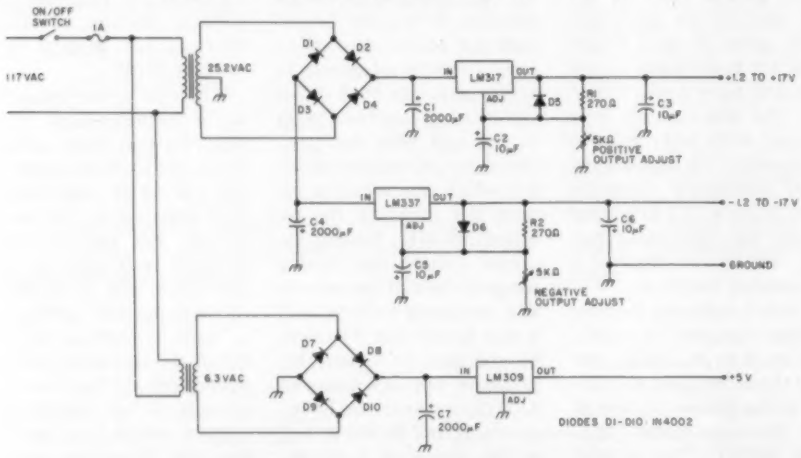

Fig. 1. Tri-voltage power supply schematic.

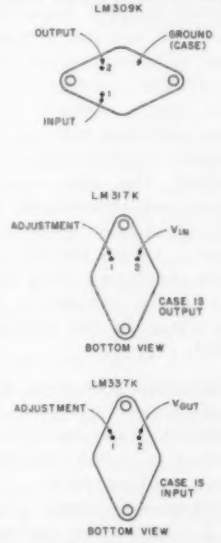

Fig. 2. Pin connections for the LM309, LM317, and LM337 voltage regulators (TO-3 packages).

tive supply is designed, except that the polarities of the capacitors and diode are reversed.

The 5-volt TTL supply section is of standard design, as described in many of the amateur radio and experimenter magazines.

Construction

Considering the number of components and the simplicity of the circuit, all connections were made with point-to-point wiring, keeping all leads as short as possible. Shown in Fig. 2 are the pin connections for the three IC regulators (TO-3 packages). Both the LM317 and LM337 must be insulated from the chassis. This is done by using insulating washers along with the required mica washer, such as the Radio Shack kit #276-1371. All controls and output jacks were mounted in an orderly manner on the front panel of an 8 x 5.5 x 3.75" metal cabinet (Radio Shack #270-269 or similar). As an additional feature, I included a pair of 0-15 volt dc edge-type panel meters that I had on hand. However, since meters of this type normally cost about $25 each, a lower-cost substitute is the 0-15 volt meter made by Radio Shack, #22-054, which sells for approximately $8. ■

	Positive Supply	Negative Supply	TTL Supply
Output Voltage	+1.27 to +17 V	−1.27 to −17 V	+5 V
Output Current	1 Amp	1 Amp	1 Amp
Load Regulation	0.1%	0.3%	50 mV
Ripple Rejection	80 dB	77 dB	80 dB

Table 1.

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Home-Brew in the Real World

—victim tells all

Why is it that all the design projects in the ham magazines have titles like, "Build Your Own Station for Under a Dollar and a Half!" or, "At last! A Linear for Ten Bucks!" It seems as though every time I turn around, some designer has cooked up a home-brew project for me which will: a) give me everything I ever wanted, and b) won't cost me more than I would spend on a pound of solder.

My suspicion is that these guys do their pricing at their jobs. I have a picture, of, let's say, an engineer for some big electronics or digital company on his lunch hour, designing things for his ham shack at home. He breadboards them at work, grabs capacitors and chips out of handy bins, and doodles until he's happy with his final product.

The next thing we know, there's an article in *73/CQ/QST/HRH* entitled "DX the World for 75 Cents!" It is not my thesis that these folks are evil men who are trying to trick me into bankruptcy, but is the real world really full of people with $5,000 junk boxes? I wish I had a dollar for every article I've seen which is headed: "Here's a Weekend Junk-box Project That Will Give You Your DXCC in Ten Minutes!"

My junk box consists of some solder and a handful of parts that I couldn't find places for in my last Heathkit.® Worse than that, even, is that if the local Radio Shack doesn't have the part that is called for in the article, I have to mail away to Arizona or someplace that takes my credit card number and promises to bill me for postage.

Take the last home-brew project that I built from a magazine. It was a fifty-dollar frequency counter—that is, on the *page* it was a fifty-dollar frequency counter. But when the author called for *one* 100k resistor, I couldn't convince Radio Shack to sell me fewer than five at a clip. The only parts that I had on hand were the jumper wires. My phone calls alone, to Arizona to check on the errant parts, cost me almost fifty bucks!

Actually, my fifty-dollar frequency counter cost me —including the case ($2.19) and the presstype ($6.95) and the chips and all the good things inside the box —something like $80.00.

However, I wouldn't have it any other way. In truth, I am now the possessor of the world's best frequency counter. It is the best because I built it. I read the schematic, I figured out the mistakes in the drawings, I wired it up, and I saw its display light up. I enjoyed the smell of the rosin core the way a gigolo enjoys Chanel No. 5. I experienced the pride of showing off a homemade piece of equipment.

And I now have a lot of leftover resistors and capacitors and IC sockets because I was forced to buy more than one of each by the packagers. I think my junk box is getting bigger as a result. Who knows? In ten or twenty years I'll be able to build a RTTY system from the parts that didn't go into all my previous projects!

I guess if my XYL knew in advance that my fifty-dollar counter was going to cost eighty dollars, she would have pulled my credit cards.

It all works out for the best! ■

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DXing the Past

—a visit to Signal Hill

For several years, my wife and I have been engaged in genealogical research into the origins of my wife's grandparents who moved from Newfoundland to Toronto around 1890. Our research could proceed no further without an actual visit to Trinity and St. John's, Newfoundland. The trip was of great interest to me from an amateur radio point of view. I had wanted to operate mobile from Signal Hill in St. John's since 1976, when I had walked up to the top of the hill to visit the Cabot Tower. Early in 1978, we had been in contact, on twenty meters, with both Newt VO1CW and Dick VO1EI about our interests and found that they had some knowledge of the families and places which were of interest to us. Gradually, the itinerary of a vacation pieced itself together, combining visits to Newt, Dick, Signal Hill, four or five small Newfoundland towns, and a few military museums. The last was to allow my son to pursue his interest in military uniforms.

In August, 1978, with the Kenwood TS-520 installed in the family wagon, operational on 10 and 15 meters, we drove via W1-, W2-, and VE1-land to North Sydney, Nova Scotia, and thence by ferry to Newfoundland. Band conditions were not particularly good, and we netted only 4 or 5 solid contacts per day until we were close to St. John's. Then a 5/9 QSO with G3MGW showed what ten can be like when it puts its mind to it, and later in the day we were working back home to Ottawa in a QSO with VE3KHT. Fifteen opened up as we drove into St. John's, with several contacts into G-land and one into OK-land. Then, having settled into our apartment hotel, we were off to Signal Hill.

As radio history buffs will know, it was here, in 1901, that Guglielmo Marconi carried out an experiment to demonstrate that signals could be transmitted by electromagnetic waves. On December 12th of that year, Marconi received three faint dots, transmitted from Poldhu in Cornwall, England: a distance of 1700 miles, and the first transatlantic DX.

Signal Hill is now a National Historic Park, and Cabot Tower, constructed in 1898 in commemoration of John Cabot's landing in Newfoundland 400 years before, is an old visual signal station. It now houses many exhibits, including details of the Marconi experiment. The parking lot next to the tower is an excellent mobile site—with a 360 degree clear view. The only drawback is its attraction for other hams and CB enthusiasts with resulting cross-modulation problems. Conditions were spotty to say the least, and although we made a number of contacts, DX and North America, in several trips to the Hill, there were only two real openings.

The first opening occurred late one evening. We had gone to the Hill at 2130 to take in the incredible view of the city of St. John's at night. We had been greeted with the typical hiss of a dead ten-meter band, and fifteen was just folding for the day. Just as we were about to leave, I gave one last sweep of the dial and, as usual at home, swept past the Ottawa ten-meter beacon, VE3TEN. But just a minute . . . what was VE3TEN doing with an S9 signal in VO1-land, hundreds of miles away? As always, ten had produced the unexpected—an opening to the west. A CQ netted a small pileup of W1s, W2s, and, finally, VE3KIE/3 and VE3TP from back home in Ottawa.

The second big opening, appropriately enough, was on our last day in St. John's. The family stayed in the apartment watching TV while I took one last trip to the Hill. Once again, at 2130 the fifteen-meter band was folding and ten sounded about as lively as a radio club meeting when the club president asks for volunteers. No sign of VE3TEN this time, but tuning over the CW portion of the ten-meter band, I came across a signal—perfect Morse at 30 words per minute. It turned out to be W1AW. Quickly swinging over to the phone band, I was just in time to hear WB1DMP signing off after a local QSO. A quick call to him, and he asked me to join him on the 10-10 Minute Man Chapter Net which was just starting. As a result, I worked those who checked into the net plus a few more W1s before the band faded as quickly as it had opened.

Our mission accomplished, the rest of the trip was devoted to genealogy, plus most enjoyable visits to VO1CW (being visited by his son, HS1ALT) and VO1EI. We had a couple of days of excellent mobile conditions on the way back home, and I was able to complete a long-standing personal goal—I now have operated from all Canadian call areas.

Arriving home, we were greeted by a QSL from WA1YRB, my last QSO from Signal Hill, saying what a thrill it had been for him to work a station operating from the site of the original Marconi experiment. It was a thrill for us too—a real DXpedition to the past. ■

REVIEW

from page 28

are only a few hundred cycles away from the DX, what then?

Have no fear, the Varifilter will come to the rescue—but first you will have to hook it up. Just open the box that Kantronics has shipped it in, dump out a few thousand soft plastic packing "worms," retrieve the warranty card and instruction booklet, and somewhere down under all that is the Varifilter. It is packaged in a two-tone beige and brown cabinet measuring about 6 inches square and only 2½ inches high.

An ac line cord is neatly coiled up and waiting for you to plug it into a source of 115-volt alternating current. If, by any chance, you don't have (or prefer not to use) ac, Kantronics has made provisions for 12-volt dc input on the back panel by means of a 2.5-mm diameter "phone" plug. When you lift the Varifilter out of its nest, you immediately notice how light it is, and how good it will look on the operating desk or maybe even on the receiver itself, as in my shack. Now, let's see, where's that instruction book? Oh, here it is. It suggests that you connect the receiver's speaker output to an RCA-type phono jack on the rear panel and plug your external speaker into a 3.5-mm jack, also on the rear panel.

The book tells you that the input voltage protection circuitry in the Varifilter will protect its innards from damage due to momentary voltage spikes and excessive and negative voltages. It's comforting to know that it won't go BZZZZTTT and curl up its toes when you hook it up. If you prefer to use headphones instead of an external speaker, just plug them into the headphone jack (standard ¼-inch style) also located on the back panel.

Now it's time to look at the front of the unit and see what knobs and switches there are to be learned (and cussed at when you select the wrong one). What's this? Simplicity itself—only three round knobs, two rectangular push-buttons, and a couple of LEDs. The left-most knob says Volume, the middle one, Bandwidth, and the rightmost knob, Frequency. The left-hand switch is power off (out)/ power on (in).

Ahhh... let's push that Power switch—the little left-hand LED rewards us with a ruby glow. So far, so good. We rotate the volume control to the right and immediately hear some CW signals coming through the Varifilter. Hmmm... wonder how they sound in the "straight through" mode? So, we push the on-off switch to off, and hear signals typical of our receiver: *lots* of signals.

Hoping that the Varifilter does, in fact, filter, I push it to *on* once more. By tweaking the frequency knob a bit, the right-hand LED begins to blink in time with an incoming signal centered in the passband. Just about right, maybe 900 Hz, or a bit less: comfortable copy. Now, I reach over to the Bandwidth knob and rotate it ever so slightly. The received signal immediately and drastically "sharpens" in the speaker. By golly, this little critter does work!

For the next hour or so I play around with the Frequency and Bandwidth controls, narrowing and widening the "window" through which we listen to the incoming signals. I find that the Frequency control is very critical when using the filter in its narrow bandwidth position, and care must be exercised to keep that little LED blinking in rhythm with the CW.

By carefully adjusting receiver tuning and the Varifilter, it's possible to achieve a remarkably comfortable and solid-copy signal through all kinds of QRM. Just to satisfy an urge to see what the receiver will do by itself, I switch the Varifilter off, and promptly lose the station I was getting Q5. Whoops... back "on" again, and there it is, still solid.

Time to see what the Peak mode switch does, so I pop it out and am rewarded with a very much enhanced signal strength—much louder than my receiver brings it to me under the same conditions. I do notice that the adjacent "hash" is also enhanced, but with a slight readjustment of the Bandwidth, the hash is gone. Wow! this is really making copy easy! And so it goes, day after day under poor band conditions, evening QRM, static, etc., etc., and I'm beginning to find out just how helpful this little Varifilter can be. After a while, I am scarcely aware it is in the circuit. Tuning across the band, I can dig out signals that I didn't know were copyable, signals that wouldn't have been readable without the Varifilter.

Ordinarily, I'm not a sideband operator and don't often use my rig in that mode. But, what the heck, the Varifilter is supposed to do its thing with SSB, too (and for that matter, ASCII, RTTY, etc.). Once again, I put the little box through its paces and found it equally adept at removing the typical sideband crud that obscures the wanted signals. Not surprisingly, the Varifilter works with little fuss, muss, and bother. It just sits there and blinks contentedly while churning out solid copy.

For those who are interested in such things, the technical facts are straightforward. The bandwidth is continuously variable from about 30 Hz to over 1000 Hz and, once set, remains constant regardless of frequency. The frequency is variable from less than 150 Hz to over 1000 Hz, thus accommodating almost any audio preference. Capable of 2 Watts audio output power, the Varifilter can drive the shack speaker or headphones to unbearable levels. Because of the variable nature of the filter, one can tune it on, above, or below the desired signal and vary the width of the audio bandpass to suit nearly any taste.

Modular design has been incorporated for serviceability and, should service ever be required, components can be removed and shipped to Kantronics for repair or replacement. Incidentally, if you wish to use the Varifilter on dc, you don't have to disconnect the ac line cord. If your shack is provided with 230 volts ac, don't despair. A tiny switch inside the Varifilter, reachable by screwdriver without removing the cover, allows you to set it for that voltage.

The instruction book is large, easy to read, clearly illustrated, and a joy to behold because it contains a nice schematic diagram and a parts list which shows the value and number of every part used. If you wish to service your Varifilter (after warranty is over), you shouldn't have any trouble, because Kantronics' instruction manual is about all you could wish for.

All in all, the Kantronics Varifilter is a most satisfacory device for the average ham and for the contester and DXer as well, making difficult copy quite easy and turning nearly impossible copy into Q5 reception. At only $139.95, the Varifilter is economically feasible and will make a worthwhile addition to any shack. I didn't try it on RTTY (or ASCII for that matter), but have no reason to suppose that it wouldn't PERFORM equally well on those modes. Try it, I think you'll like it! For further information, contact *Kantronics, 1202 E. 23rd Street, Lawrence KS 66044; (913)-842-7745.*

Jim Gray W1XU
73 Staff

MFJ SHORTWAVE CONVERTER

Like many other hams, I have always enjoyed listening to the shortwave broadcast bands. The BBC, Voice of America, Deutsche Welle, Radio Moscow (in very small doses!), and countless others provide commercial-free programming of a very high quality. A lot of hams would like to spend more time listening, but they just can't seem to find the time. When it comes down to a choice between operating the ham station and listening to shortwave broadcasts, the ham station always wins!

A few years ago, I briefly considered getting a radio with shortwave capabilities for my car. What could be better than to catch up on a some shortwave listening while driving to work? I quickly dismissed the idea when I found out how much such a car radio costs. Only a few very expensive European models offer shortwave coverage, and I wasn't about to buy a radio that was worth more than the rest of the car!

Recently, MFJ began advertising two shortwave converters for the car. The MFJ 304 covers 19, 25, 31, and 49 meters in four bands, and the MFJ-308 covers all the above and adds 13, 16, 41, and 60 meters. This seemed too good to be true. I imagined that the sensitivity would be low and the selectivity would be poor,

but at $79.95 for the eight-band model, the little box was sorely tempting, and I banged off an order to MFJ Enterprises.

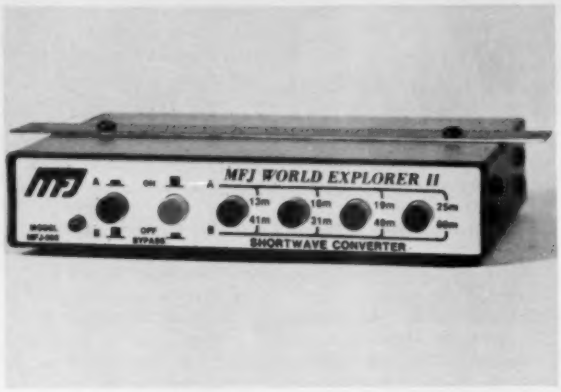
When the package came a couple of weeks later, I dropped everything, grabbed my toolbox and ran out to the car. Groping around under the dashboard in the middle of a New Hampshire winter isn't exactly a laugh a minute but, fortunately, installation only took about 15 minutes.

I unplugged the car's antenna lead from the radio, plugged it into the converter, and plugged the output of the converter into the antenna jack on the radio. The converter operates on 12 V dc, which is easy to get in my car; I just tap into the filtered line I have for two-meter equipment. That's all there is to it!

I am a compulsive manual reader, so I checked the manual before I went any further. I needn't have bothered; operation couldn't be simpler. The converter is normally in the off state. When you push in one of the band switches on the front panel, the converter is activated. Tuning is then accomplished normally with the tuning knob on your car's am radio. When you want to listen to stations on the local broadcast band, you merely push the off switch and the converter is switched out of the circuit completely.

With no further ceremony, I punched the bandswitch for a band known for its daytime activity, and started tuning around. I was absolutely astounded. The thing was amazing! Any fears I had about sensitivity were banished. As I tuned up and down the band I heard exceptionally strong signals everywhere, and the selectivity was excellent. I was so excited that I didn't know what to do with myself, and several other *73* staffers who came out to see what the commotion was all about were equally impressed. In the next twenty-four hours I found all sorts of excuses to go for a drive, and each time I was rewarded with the reception of several interesting programs from every corner of the globe. MFJ has a winner.

Problems? Yes, I had a couple of minor problems. The mounting brackets included with the converter are a bit on the small side and I'd rather see MFJ furnish the more typical U-shaped bracket. Admittedly, such a bracket would add to the cost of the unit, and since you aren't likely to be moving the converter around very often, the slight inconvenience of the present system is acceptable.



MFJ's shortwave converter.

The only other problem doesn't have anything to do with the converter itself, but can involve your car instead. If your car's ignition system isn't up to snuff, it can produce a tremendous amount of amplitude-modulated hash. If your present radio can hold its own against this ruckus, the converter will do fine, too, as long as you don't try to listen to extremely weak stations, which tend to get lost in ignition noise. If your car's ignition noise is well under control and your am radio has good sensitivity, you'll be able to DX to your heart's content.

Serious problems are conspicuous in their total absence. This unit performs so well that I am surprised that there aren't more such converters on the market. The entertainment and educational value of this little box from MFJ is fantastic. If you have any interest in shortwave listening, MFJ has an incredible value for you!

The MFJ World Explorer II is available from *MFJ Enterprises, Inc., PO Box 494, Mississippi State MS 39762.* Reader Service number 484.

Paul Grupp KA1LR
73 Staff

BENJAMIN MICHAEL INDUSTRIES 24-HOUR CLOCK

What can one say about a clock, you ask? Plenty, if it's this quartz-crystal controlled twenty-four-hour clock from BMI.

How many times have you agonized over the conversion of local time to UTC? Well, maybe you're smarter than I am, but I always have a problem going from Eastern Standard or Eastern Daylight to UTC. I'll admit it is a bit simpler before noon, but in the *afternoon*, Ugh!

Enter Benjamin Michael Industries with their little liquid-crystal-display clock. It sits quietly on the table top, receiver, shelf, transmitter, windowsill, or wherever your imagination might suggest. BMI provides small mounting lugs on each side of the plastic case so that the clock can be mounted in a panel. It can be attached to any number of other things by means of those lugs—it's versatile, too!

A front-panel toggle switch and two push-buttons allow you to set the time as follows: flip the toggle to Set and cycle the hours and minutes with the Hours and Minutes push-buttons until the proper numbers come up in the window. As soon as WWV or CHU give their time-set tones, just flip the toggle back to the left and you're on time. Seconds are ticked off unobtrusively yet visibly by the blinking of the colon that separates hours and minutes. It is pleasant to finish a QSO and just look at the time expressed in hours amd minutes UTC—makes a log-keeping a snap!

The liquid-crystal display is set within a surrounding bezel which is mounted on an alodined or anodized (black) aluminum front panel. The 1.5-volt pen cell mounts in a clip on the bottom of the case. Inside is a glass-epoxy printed-circuit board which appears to be gold-plated for corrosion resistance. The back of the case incorporating the mounting "ears" is easily removed by two small screws set into the sides of the case, near the rear edges.

There is a slot at the bottom rear of the assembled unit which appears to be wide and long enough (¼" W × 2" long) to accommodate something like a ruler or yardstick. There is a tiny hole for a screw in the center of the back, suggesting that this little clock could be mounted at one end of a long, thin stick, like a yardstick. I'm not sure why anyone would want to do that, but it does seem possible, *if* you want to. Maybe it's for a pendulum; do you suppose. . . ?

I have watched the little clock perform like a champ for two whole weeks, and know what? It hasn't lost or gained a millibleem, measured against WWV, in all that time.

For $24.95, how can you hate it? You can't! Get one, because you need it to keep from going bananas trying to figure out UTC. More information can be obtained by contacting *Benjamin Michael Industries, PO Box 173, Prospect Heights IL 60070.* Reader Service number 482.

Jim Gray W1XU
73 Staff

MASTER HANDBOOK OF ELECTRONIC TABLES & FORMULAS by Martin Clifford

In the introduction to this book, the author notes that there are a number of ways to solve problems in electronics. The first is to use formulas and to plug in or substitute numerical values. As the author states, "This technique calls for some arithmetic dexterity and, quite often, a good working knowledge of algebraic and trigonometric functions, and sometimes a bit of calculus. Aside from the work involved, the use of a formula has the disadvantage in that it supplies a single solution."

The second method of solving problems in electronics involves the use of nomographs which also can give a number of alternative solutions.

A third method is provided in this book by presenting electronics data in tabular form with minimal use of arithmetic. The answers to electronics problems are given immediately in the tables if the elements of the

problems are known.

The tables are based on standard formulas used in electronics and provide answers of a much higher order of accuracy than is commonly needed for the solution of electronics problems. The tables also provide a number of alternate solutions much as do nomographs, allowing the user a choice of practical component values that may be required in circuits.

Of interest to the amateur are tables giving solutions for resistance and conductance involving such things as equivalent resistance of two resistors in parallel, resistance vs. conductance, resistivities of conductors, and design values for three types of attenuator networks, T-pad, H-pad, and π-pad. There are tables on voltage and current, capacitance, inductance, impedance, permeability, power decibels, and sensitivity.

If, for example, you require a simple attenuator pad to supply an insertion loss of 40 dB, you can go to the table on Design Values for Attenuator Networks and, for a T-pad, locate 40 dB in the left-hand column of the table. Then, to the right of this value, read the values for R1 and R2, where R1 represents two resistors each having a value of 588.1 Ohms. R2 is shown as having a value of 12 Ohms. The same method can be used to locate desired resistance values for the H-pads and π-pads.

There is a chapter on antennas which I found of little use for the amateur. The standard publications for amateurs are much better sources of antenna information and it is my feeling that some other aspect of electronics could have been substituted for this short chapter on antennas.

For the amateur interested in computers, there is a chapter on digital logic and number conversion tables and a chapter on symbols, codes, and alphabets which includes the American Standard Code for Information Interchange (ASCII).

For the constructor, there are chapters on transistors covering alpha vs. beta and methods of testing transistors, wire, color codes, time constants, and both RC and RL constants.

As the author indicates in his introduction, there is a limit to the number of electronics tables that can be prepared. When a problem requires more than two component parts of the formula, it is better to use the formulas or nomographs than to try to set up tables.

As stated, this book's purpose is to save time and work, and on this basis I found this book useful and worth its $14.95 price. It is available from *Tab Books, Inc., Blue Ridge Summit PA 17214.*

Edwin R. Lappi WD4LOO
Carrboro NC

HAM HELP

We are happy to provide Ham Help listings free, on a space-available basis. We are not happy when we have to take time away from other duties to decipher cryptic notes scrawled illegibly on dog-eared post cards and odd-sized scraps of paper. Please type or print (neatly!), double spaced, your request on an 8½" × 11" sheet of paper and use upper- and lowercase letters where appropriate. Also, please make a "1" look like a "1," not an "l," which could be an "el" or an "eye," and so on. Hard as it may be to believe, we are not familiar with every piece of equipment manufactured on Earth for the last 50 years! Thanks for your cooperation.

I have a Koyo Model JL-451 CCTV camera and need a photocopy of the owner's manual. Also, does anyone have a modification for improving the product detector in an HQ-110A VHF made by Hammarlund?

Finally I need an SSTV alignment tape. I will copy and return.

Ira Linderman WB2RXR
89 Dovecote Ln.
Commack NY 11725

Help! I need some assistance down here in South America.

First, I need help in getting the paperwork completed for my local amateur license. I am told that it would be much faster if I had another ham who knows the ropes to help. I have listened to the local repeater till I am somewhat blue, but no one ever gives out their phone number and of course I do not dare give a call, since the laws here are very strict about that.

Second, I am looking for a simple circuit which will help us in a Bible competition—a question and answer type of program. The requirements would be as follows:

One button per each team member. Three teams, 4-6 members per team. When a team member's button is pushed, it would lock out all other buttons, while lighting a light on the button block and an LED or digital readout for the team and team member on the console. A reset button on the console would also be needed.

Finally, I am looking for an IC that would work with a TT decoder project I am working on for my bench and for possible use with a portable repeater when I return to the United States in three and a half years. For the first prototype, I plan to use 567s since they are somewhat available here (even though very overpriced).

I am looking for a chip that would give me a numeric readout rather than one of a row of LEDs to signify the decoded digit. Being somewhat of a beginner, I am not sure which chip or IC would be a good choice.

At present, the 567 output is fed to a 7402 or one of three 7402s which in turn gives a high output depending on the digit decoded, i.e., 1-0, *, #. Thus, the feed or output to the needed IC would be any one of 12.

I would appreciate any help which readers could give on these matters. Thank you very much and may God bless you.

Major Fred Musgrave WB3HCW
Special Projects Director
Ejercito de Salvacion
Sucursal 3, Casilla 194
1403 Buenos Aires
Argentina

I need a Collins 32S1 transmitter in any condition—either repairable or for parts.

H. F. Schnur
115 Intercept Ave.
North Charleston SC 29405

I badly need a copy of a manual for a General Radio 1021-A signal generator. I will pay any reasonable fee.

George Shira WD4BUM
Rt. 7, Box 101-I
Anderson SC 29624

I need a Hallicrafters SR400 or SR400A crystal lattice filter, part no. 049-000851. Can anyone help?

Marv Westerdahl KA0ILK
1600 Frontier Ln.
Olathe KS 66062

I would like information on a radio I picked up at a junk sale. It is a 6-meter radiophone (DeWald by U.S.L.). I would like to find out as much as I can about the radio or sell it to someone who could use it. By the way, it has an 8450-kHz crystal.

Fred Nordstrom KA4IZK
Rt. 2, Box 26
Calvin KY 40813

I am involved in a high school science project and need any parts, complete units, etc., of the AN/USM 32 oscilloscope. I will pay all postage.

R. G. Hall W6BSH
1381 Taper Ct.
San Jose CA 95122

The Louisiana Slow Net is looking for any amateurs interested in traffic handling. The LSN meets Monday through Friday at 0130 UTC on 3.703 MHz. Interested parties should send an SASE.

Stephen V. Genusa WD5EAE
2106 Park Avenue
Monroe LA 71201

I have just acquired an old Vibroplex no. 176056 key. It is in nearly mint condition. Can anyone tell me how I can learn the year of its manufacture?

D. L. Bassler WD4KAX
330 Country Club Dr.
Tequesta FL 33458

I need a power transformer for a Heathkit® HX-10 SSB transmitter. Primary: 117 V ac; secondaries: 5 V @ 2 A, 5 V @ 2 A, 6.3 V @ 9 A, 222 V c-t, 814 V c-t, and 1880 V c-t. It is Heath part number 54-114.

Jud White WA2PMH
50 N. Greenwood Ave.
Hopewell NJ 08525

SOCIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received two months prior to the month in which the event takes place. They should be sent directly to Editorial Offices, 73 Magazine, Pine Street, Peterborough NH 03458, Attn: Social Events.

OLD BRIDGE NJ
MAR 1

The Old Bridge Radio Association will hold its first annual auction of ham radio, electronic, and computer equipment on March 1, 1981, at the Cheesequake Firehouse, intersection of Rtes. 35 and 9, Old Bridge NJ. The exhibition will begin Sunday morning at 11:00 am, and the sale will begin at noon. Refreshments will be available. Talk-in on .72/.12 and .52. For more information, call Fred Goldberg at (201)-257-8753.

DAVENPORT IA
MAR 1

The Davenport Radio Amateur Club will hold its tenth annual hamfest on March 1, 1981, from 8:00 am to 4:00 pm at the Davenport Masonic Temple, Highway 61 (Brady Street) and 7th Street, Davenport IA. Tickets are $2.00 in advance, $3.00 at the door. Tables are $4.00 each with a $2.00 additional charge for an electrical hookup (limited number). Features will include over $2,000 worth of major prizes. Hotel discounts and refreshments will be available. There will be a pre-hamfest Saturday night banquet with Paul Graver, midwest ARRL SCM, as guest speaker. Banquet tickets are $8.00 and reservations must be paid by February 18, 1981. Talk-in on 146.28/.88, W0BXR. For advance tickets, dinner, and table reservations, write Dave Johannsen WB0FBP, 2131 Myrtle, Davenport IA 52804.

GRAND JUNCTION CO
MAR 7

The Grand Mesa Repeater Society will hold the second annual indoor Western Slope Swapfest on March 7, 1981, at the Lincoln Park Barn, 12th and Gunnison, Grand Junction CO. Doors will be open from 10:00 am through 4:00 pm and admission is free. Swapfest tables are $4.00 in advance. Attractions will include commercial exhibitors, a flea market, an auction, and prizes. Raffle tickets for the grand prize of a Tempo S-1 are $2.00 each. Talk-in on 146.22/.82. For further information, send an SASE to Larry Brooks WB0ECV, 3185 Bunting Avenue, Grand Junction CO 81501, or call (303)-434-5603.

STERLING IL
MAR 8

The Sterling-Rock Falls Amateur Radio Society will hold its 21st annual hamfest on Sunday, March 8, 1981, at the Sterling High School field house, 1608 4th Avenue, Sterling IL. Advance tickets are $2.00 and tickets at the door are $2.50. A large indoor flea market will be restricted to radio and electronic items only. Tables are available for $5.00 for commercial and $3.00 for others. Plenty of free parking will be available, including an area to accommodate campers and mobile trailers. Many prizes will be given away, including a first prize of a minicomputer. Doors open at 7:30 am. Featured will be a movie, "The World of Amateur Radio," to be shown throughout the day, bargains, good food, and plenty of close-by activities for XYLs and kids. Talk-in on .52 and WR9AER .25/.85. For advance tickets and tables, write Sue Peters KA9GNR, 511 8th Avenue, Sterling IL 61081. Make checks payable to Sterling-Rock Falls Amateur Radio Society and enclose an SASE.

MIDLAND TX
MAR 14-15

The Midland Amateur Radio club will hold its annual swapfest on Saturday, March 14, 1981, from 1:00 pm until 7:00 pm, and on Sunday, March 15, 1981, starting at 8:00 am, at the Midland County Exhibit Building east of Midland TX on Highway 80. There will be door prizes. Preregistration is $4.50 or $5.00 at the door. Talk-in on 146.16/146.76. For more information or to pre-register, write the Midland Amateur Radio Club, Box 4401, Midland TX 79704.

TRENTON NJ
MAR 15

The Delaware Valley Radio Association, W2ZQ, will hold its 9th annual flea market on Sunday, March 15, 1981, from 8:00 am to 4:00 pm at the New Jersey National Guard 112th Field Artillery Armory, Eggerts Crossing Road, in Lawrence Township, NJ. Advance registration is $2.00, $2.50 at the gate. There will be indoor and outdoor flea market areas. Sellers are asked to provide their own tables. Prizes and refreshments will be available. Talk-in on 146.07/.67 and 146.52. For additional information or tickets, write DVRA, PO Box 7024, West Trenton NJ 08628. Please include an SASE.

WINCHESTER IN
MAR 15

The Randolph Amateur Radio Association will hold its 2nd annual hamfest on Sunday, March 15, 1981, from 8:00 am to 5:00 pm, at the National Guard Armory, Winchester IN. Admission is $2.00 in advance or $3.00 at the door. Table space is $2.50 and table space with table (limited supply) is $5.00. Space reservations must be made in advance. Features include prizes, programs, new equipment displays, a flea market, and refreshments—all indoors with security. Talk-in on 147.90/.30, 223.30/224.90, and 146.52. For advance reservations and information, contact Jake Life W9VJX, Box 162, Winchester IN 47394, or phone (317)-584-9361.

CANTON OH
MAR 21

The Canton Amateur Radio Club will hold its annual auction on March 21, 1981, at the Nimishillen Grange Hall, Easton Street NE, Canton OH. The doors will open at 4:00 pm and the auction will start at 7:30 pm. An Icom IC-2A and an antenna tuner will be given away as door prizes. The two-meter check-in prize will be an Avanti antenna. Check-in on 146.19/.79. For advanced tickets and/or further information, send an SASE to R.A. Stellarini WB8VUN, 1003 Shadyside Avenue SW, Canton OH 44710, or phone (216)-453-5896 after 5:00 pm.

MARSHALL MI
MAR 21

The Southern Michigan Amateur Radio Society and the Calhoun County Repeater Association will sponsor the 20th annual "Michigan Crossroads" Hamfest on Saturday, March 21, 1981, at the Marshall High School, Marshall MI. Doors will open at 7:00 am for exhibitors and at 8:00 am for buyers and lookers. Free parking, unloading help, and food service will be available. There will be a special craft section for the ladies, and door prizes and talk-in prizes will be awarded. Table space is $.50 per foot and will be reserved until 9:00 am. Talk-in on .07/.67 and .52. For more information, write SMARS, PO Box 934, Battle Creek MI 49016, or call Earl Goodrich at (616)-781-3554.

SO. SIOUX CITY NE
MAR 21

The 3900 Club and the Sooland Repeater Association will sponsor Hamboree 5 on Saturday, March 21, 1981, at the Marina Inn, So. Sioux City NE. Doors will open at 9:00 am. Advance registration, including the banquet, is $10, tickets at the door are $12, and the Hamboree only (no dinner) is $2. Present will be Midwest Director Paul Graver W0FIR and *QST*'s Stuart Leland W1JEC, who will present two programs. Features include CW contests, a special Novice meeting, many programs throughout the day, commercial exhibitors, a flea market, oldtime radio and amateur exhibits, and prize drawings. At 6:00 pm, there will be a banquet featuring Toastmaster John Daniels WA0GQK. There will be special programs for the ladies. Reservations for a 3 × 8 foot table are $2 and can be made by contacting Al Smith W0PEX, 3529 Douglas Street, Sioux City IA 51104. For advance tickets and motel reservations, write Jerry Smith W0DUN, Box 14, Akron IA 51001. For more information, contact Dick Pitner W0FZO or Glen Holder K0TFT.

CHARLOTTE NC
MAR 21-22

The Mecklenburg Amateur Radio Society, Inc., will sponsor The Charlotte Hamfest and ARRL North Carolina state convention on March 21-22, 1981, at the Civic Center, Charlotte NC. Close by are hotels, restaurants, and secure parking. Aisle booths are $60.00 and end

booths (in pairs) are $160.00. This includes a name sign, two tables, dividers, and electricity. For more information or booth reservations, write The 1981 Charlotte Hamfest, Mecklenburg Amateur Radio Society, Inc., 2425 Park Road, Room 023, Charlotte NC 28203, Attention: Bob Darke W4MHF. On Friday, March 20, 1981, the annual Charlotte Hamfest "Attitude Adjustment" party will be held in the Civic Center Hospitality Room.

IRVINGTON NJ
MAR 22

The Irvington Radio Amateur Club will hold its hamfest on Sunday, March 22, 1981, from 9:00 am to 4:00 pm at the P.A.L. Building, 285 Union Avenue, Irvington NJ. Take the Golden State Parkway to exit 143 north or 143A south. There will be refreshments available. Admission is $1.00 and tables are $3.00. Talk-in on .34/.94 and .52. For further information, call Pete WB2FAS (201)-763-8220, or write IRAC, P.A.L. Building, 285 Union Avenue, Irvington NJ 07111.

MAUMEE OH
MAR 22

The Toledo Mobile Radio Association, Inc., will hold its 26th annual auction and hamfest on Sunday, March 22, 1981, at the Lucas County Recreation Center, Key Street, Maumee OH. Hours are from 8:00 am to 5:00 pm. The free auction starts at 10:00 am. There will be ample free parking all day and overnight. Tickets are $2.00 in advance and $3.00 at the door. Flea market tables are available; displays are limited to electronics and ham gear. There will be commercial exhibits, refreshments, door prizes, and a big raffle—all inside. Prizes include a Kenwood TS-130 with power supply, two Icom IC-2AT HTs, a Bird Wattmeter, and many more. There will be an additional ladies' program. Bring your YL, XYL, or OM and make a day of it. Talk-in on 146.52/.52. Area repeaters are 146.01/.61, 146.19/.79, 146.34/.94, 147.87/.27, and 147.975/.375. For additional information, write J. Honisko N8BGH, 1733 Parkway Drive N., Maumee OH 43537.

COLUMBUS GA
MAR 28-29

The Columbus Amateur Radio Club will hold its hamfest on March 28-29, 1981, at the Columbus Municipal Auditorium. Admission is free. A ticket donation is $1.00, and inside swap tables are $5.00 per day. There will be a free outside flea market. This is an ARRL hamfest and will include an ARES forum. Talk-in on .28/.88. For table reservations, contact K4RHU, 2701 Peabody Avenue, Columbus GA 31904, or phone (404)-322-7001. For more information or tickets, contact N4ATI, 263 Logan Avenue, Ft. Benning GA 31905, or phone (404)-687-3272.

PHILADELPHIA PA
MAR 29

Penn Wireless Association, Inc., will hold its Tradefest '81 on Sunday, March 29, 1981, at the National Guard Armory, Southampton road and Roosevelt Boulevard (Rte. 1), ½ mile south of exit 28 on the Pennsylvania Turnpike, Philadelphia PA. General admission is $3.00 and a 6' × 8' seller's space is $5.00 with an additional $3.00 for a power connection (limited number). Each sales space will entitle the seller to one free admission. Doors will open at 7:00 am for setup and at 8:00 am for general admission. Features will include prizes, refreshments, displays, rest areas, and surprises. Talk-in on 146.115/.715 and .52. For more information, contact Kenneth Marinoff K3FKW, PO Box 734, Langhorne PA 19047.

MADISON OH
MAR 29

The Lake County Amateur Radio Association will hold its 3rd annual Lake County Hamfest on Sunday, March 29, 1981, at the Madison High School, Madison OH. Admission is $2.50 in advance (send an SASE before March 14, 1981) and $3.50 at the gate. Display space, including table(s) if desired, is 85¢ per linear foot. Table rent with reservation will hold a space until 10:00 am. Highlights will include commercial exhibits for ham and computerist, an inside flea market, a computer raffle with a prize of an Ohio Scientific C1P Series 2 personal computer with monitor, cassette, and 8K RAM. Also, door prize drawings will be held hourly, with first prize being a Ten-Tec Delta 580 with 280PS. Plenty of overnight accommodations are available within a 15-minute drive. Talk-in on 147.81/.21. Check-in on 146.52/.52. For further details, write Lake County Hamfest Committee, 5555 Anaconda Road, Mentor OH 44060, or call (215)-953-9784.

BRAINTREE MA
MAR 29

To celebrate its 50th anniversary in amateur radio, the South Shore Amateur Radio Club will hold an indoor flea market on Sunday, March 29, 1981, at the Viking Club, 410 Quincy Avenue, Braintree MA, from 11:00 am to 4:00 pm. The entrance fee of $1.00 includes one chance for the door prizes. Additional chances may be purchased at 3 for $1.00. There will be eight-foot tables available for $7.50 each (which includes one free admission). Vendors will be able to set up at 10:00 am. Plenty of free parking will be available. For advance table reservations, send a check, payable to the South Shore Amateur Radio Club, to Ed Doherty W1MPT, 236 Wildwood Avenue, Braintree MA 02184

ROCHESTER MN
APR 4

The Rochester Amateur Radio Club and the Rochester Repeater Society will sponsor the Rochester Area Hamfest on Saturday, April 4, 1981, at a new location, John Adams Junior High, 1525 NW 31 Street, Rochester MN. Doors will open at 8:30 am. There will be a large indoor flea market for radio and electronics items, prize raffles, refreshments, and plenty of free parking. Talk-in on 146.22/.82 (WR0AFT). For further information, contact RARC, WB0YEE, 2253 Nordic Ct. NW, Rochester MN 55901.

UPPER SADDLE RIVER NJ
APR 4

The Chestnut Ridge Radio Club will hold a ham radio and computer flea market on April 4, 1981, from 9:00 am to 3:00 pm at the Education Building, Saddle River Reformed Church, East Saddle River Road at Weiss Road, Upper Saddle River NJ. Tables will be available for $10; tailgating, $5. There is no admission fee. Food and drink will be available. For further information, contact Jack Meagher W2EHD, (201)-768-8360, or Neil Abitabilo WA2EZN, (201)-767-3575.

GOTEBORG SWEDEN
APR 4-5

The Goteborg Transmitting Amateurs invite all interested hams to an international ham meeting in the Swedish Trade Fair Centre, Goteborg, Sweden, on April 4-5, 1981. Featured will be a thematic stamp exhibition; lectures on VHF, UHF, and SHF; and meetings for YLs, award-hunters, and DXers. Other programs to be announced are fox-hunting, a mobile-radio contest, and a CW speed contest. A hamfest will be held on Saturday night.

PADUCAH KY
APR 5

The Paducah ARES Club will hold its 2nd annual ham/swapfest on Sunday, April 5, 1981, from 8:00 am to 5:00 pm, at the National Guard Armory, Paducah KY. There will be hourly as well as grand prize drawings. Dealers will be on hand. Talk-in on 147.66/.06 and 146.52. For additional information, contact Larry Reid AI4T, Chairman, 220 Longview Drive, Paducah KY 42001.

FRAMINGHAM MA
APR 12

The Framingham Amateur Radio Association will hold its annual Spring flea market on Sunday, April 12, 1981, at the Framingham Police Station drill shed, Framingham MA. Doors will open at 9:00 am and admission is $1.00. Sellers' tables are $7.00 in advance and $8.00 at the door. Talk-in on .75/.15 and .52. For more information or seller pre-registration, contact Ron Egalka K1YHM, 3 Driscoll Drive, Framingham MA 01701, or phone (617)-877-4520.

AMBOY IL
APR 26

The Rock River Amateur Radio Club will hold its 15th annual hamfest on April 26, 1981, at the Lee County 4H Center in Amboy IL, one mile east of the junction of Rtes. 52 and 30, 10 miles south of Dixon IL. There will be free coffee and donuts starting at 8:00 am. Camping space will be available at a nominal charge. Six-foot display tables are $5.00 each and tickets are $1.50 in advance, $2.00 at the gate. Talk-in on .37/.97 and .52. For full details, contact Charles (Chuck) Randall W9LDU, 1414 Ann Avenue, Dixon IL 61021, or phone (815)-284-6380.

LETTERS

from page 20

and more people interested in hamming not only for a possible career but just a "good life." You pursued a career with ham radio. I, the "good life" as an executive in a large corporation!

J. F. Irwin W6ECB
San Francisco CA

ONE MAN'S OPINION

With regard to Wayne's editorial in the December, 1980, issue, it is reasonable to assert that the use of calculus and lots of mathematical equations is not essential to the pursuit of radio technology by amateurs or technicians, and to be guided by this conviction is tailoring the articles which you publish. It is unreasonable to take the same editorial opportunity to condemn college calculus in general as you seem to have done. The danger in such condemnation is its possible influence on impressionable younger readers who admire you for your many accomplishments and thus tend to attach undue importance to what is really just one man's opinion.

Many of these youngsters are faced with important career decisions and will latch on to any guidance they can find. Some are contemplating enrollment in university courses of science or engineering, courses for which calculus is a requirement despite your low opinion of its merit. These people should be advised that opinions differ widely on the role of mathematics in the sciences, and that yours is representative of just one extreme. Everywhere in the ham community can be found dedicated, intelligent, and successful people who are diametrically opposed to the views you express.

Calculus is the mathematics of motion and change. As such, it plays a vital role in the exposition and understanding of physical principles, indeed, so much so that it has become part of the very language in which many sciences are couched. Thus, the student must know a fair amount of calculus to cope with the science texts that he is required to master, or to comprehend the lectures which are an essential part of his science education. To disdain the calculus is to disdain communication with some of the greatest minds of past and present. Most working scientists employ both mathematical and physical reasoning in their work, emphasizing one or the other, depending on their personal tastes and talents. When the going really gets tough, they are happy to try any tool available.

Please bear in mind that nearly a half century has elapsed since Wayne's own, unfortunate encounter with college math. Many drastic changes have occured both in the way the material is presented and in the extent to which students must acquire proficiency in it if they are to get the most from their subsequent courses in the sciences.

In 1940 only a relatively few Americans went on from high school to colleges and only a small fraction of college students enrolled in calculus. Today the subject is taught in many high schools, and probably a lot of the brighter students who opt for the course are themselves part of the very ham fraternity that you are so eager to serve.

In time, these students will acquire proficiency not only in calculus, but in disciplines such as linear analysis and matrix algebra whose practical importance has been amplified by the emergence of electronic computers, and whose practical need has been amplified by things like the increased attention which engineers are devoting to systems theory.

So please try to be more tolerant. When someone submits an article containing a few equations, don't just dismiss it as a display of ego or pedantry. Perhaps the author was just trying to express himself in the way which seemed clearest to him. Can you be so sure that you are an infallible guide as to how it would be clearest to others? No manner of presentation has a monopoly on clarity or success.

Larry Potts W2FOH
Williamsville NY

SAFETY FIRST

I am very far behind in my reading. However, I would still like to comment on the article in the August, 1980, *73* by WB6MXD for constructing the Gel/Cell charger ("A Different Kind of Charger," p. 115).

I would like to point out that any device powered from the 120 V ac power line or even from a battery capable of delivering large amounts of current should never be built without being appropriately fused.

To be safe, this charger should have a fuse not exceeding ½ Amp in the 120 V ac primary circuit, and to be totally safe should also have a fuse not exceeding 1 Amp in the ac secondary circuit.

Most everyone would be amazed at how fast wire insulation can burst into flames when current flow is not restricted. If a diode shorts in a rectifier bridge, this can easily occur.

Rodger Williams N6BRG
Minneapolis MN

CARROT DANGLING

I'd like to comment on Wayne's idea of a code-free (theory-free?) ham license. We already have one! It's called the Novice License. The code and theory required for Novice are so simple that anyone who can read can get a ticket. Even some bright gradeschoolers are licensed.

Most people who don't know about code or electronics are afraid to learn anything about ham radio. Learning code and theory is work. Work should have a reward. The CW-only Novice license is not enough reward for people who are accustomed to voice communication. It's hard to convince a CBer or teenager to learn code, theory, and laws for a radiotelegraph ham license. This is especially so when he finds out he must learn more code, more theory, and more laws, and then have to travel to a distant city for the exam for a radiotelephone ham license.

Almost everyone has had a prospective ham become discouraged to find out that the Novice ticket you're offering to help with will allow only CW contacts and, worse still, that the equipment for the four bands *is* expensive. For the prospective Novice to invest that much work and money is a big decision. I feel that more would make that decision if phone privileges were included in the reward. Not a lot of privileges, but just enough for a carrot.

For example, a new phone subband at 28.4 to 28.5 with a 250-Watt limit. Novices could meet with all other classes of hams on this band, get encouragement, ask questions, and gain experience. I'll bet that more interesting CW contacts would come from Novices who are exposed to a little phone fun. I'll also bet more Novices would be licensed because of phone privileges.

So, how about an easy-code (easy-theory?) license with a carrot to entice the newcomer?

Larry W. Garens WD8CIY/5
Brady TX

QRZ HAWAII

The McKinley High School Amateur Radio Station (KH6NF) is trying to make contact with teenagers and young adults around the world. McKinley High School is the oldest public high school in the state of Hawaii, being 115 years old this school year. We are located in Honolulu, just minutes away from the famous Diamond Head crater and Waikiki Beach. Our student population is just over 2000 students and would rival the United Nations with our diversity of culture and national heritage.

The club station has been in operation since 1966, but this year we are making a special effort to contact other club stations and younger members of the amateur radio society. We are inviting everyone to join us on the bands and make this year an outstanding one for the youth in amateur radio.

Our hours of operation will be from 1730Z to 1815Z and 0045Z to 0130Z Monday through Friday, and 2000Z to 2130Z Monday, Wednesday, and Friday. At present, we operate on 28.530 MHz ± QRM. If 10 meters closes up, we will operate 21.320 MHz or 14.320 MHz. We also operate in the Novice band on 21.195 ± QRM.

If you are unable to contact us because of poor band conditions, please drop a line to set up a schedule and we will do our best to have a QSO with you.

McKinley High School
Amateur Radio Station
1039 S. King Street
Honolulu HI 96814

SAVE LIVES

Thanks for encouraging repeater owners to install emergency locator transmitter (ELT) monitors. Such monitors definitely assist search and rescue (SAR) forces in two important ways. First, in many areas of the country no one monitors 121.5 MHz so repeaters can often be the first to report a distress signal. Second, the moderate height of most repeaters (when compared to a search aircraft or a ground-level search team) provides valuable information in reducing a search area to a manageable size.

Others in the amateur community also can assist in SAR. Homebuilders, designers, and commercial firms can work on creating inexpensive but selective and sensitive 121.5- and 243.0-MHz direction finders and receivers. Commercial firms might also market DFs in kit form to keep costs down. Traffic handlers can offer their services to local SAR teams. Transmitter hunters with equipment for 121.5 or 243.0 are always welcome. All of these areas make good club projects as well. The resulting favorable publicity certainly would help the club and amateur radio in general.

Amateurs interested in this work should get in touch with the SAR organization in their area. If they know someone in their local Mountain Rescue Team or Civil Air Patrol unit, then that's a good place to start. If not, they can write to HQ CAP–USAF, Maxwell AFB, AL 36112, for the address of their state's CAP Wing. I can also provide this information if they wish.

I hope that many more amateurs will find, as I have, that saving lives can be more rewarding than just saving QSLs.

Gary C. Wilson WB2BOO
Major, CAP
Emergency Services Officer
PO Box 16099
McGuire Air Force Base NJ
08641

ELITISTS

Must we be subjected to such unthinking and irresponsible drivel as KB7HM proposes (*73*, December, 1980), namely the elimination of theory from the licensing exams? It has already been tried in the CB service, and look at the mess that has resulted! Do we want this on the ham bands as well? Is learning such a painful process?

To examine the question from another angle, what benefits, if any, do we achieve as a result of theory requirements in the exams? "That," as Mr. Shakespeare said, "is the question."

Hams may well look with pride at their many contributions to the science of radio communications and many associated arts. I submit that much of this progress has come about because the technical requirements that KB7HM would eliminate are accepted as demonstration that the individual knows enough of what it is all about so that the freedom to innovate, to experiment, can safely be entrusted to him or her, as the case may be. As an example, while I cannot buy a ten-meter linear, there is no problem with my making and using one. It is this freedom which has made ham radio what it is, in contrast to the electronic anarchy that we find on eleven meters.

If we were to abandon requirements to have at least a glimmer of what makes the wheels go 'round, the future of ham radio might as well be turned over to the equipment manufacturers, who would certainly lick their figurative chops at the prospect of hordes of new (and ignorant) customers to buy their goodies.

If ham radio is not to degenerate into another CB mess, where a fistful of bucks is the only requirement, technical know-how must remain an important factor in licensing, and ham radio will again be capable of providing many technically oriented men and women for industry, or for national emergency, as in the past.

Elitist group? You're damn right! We hams have over the years earned the right to that title! Those who find it too difficult, too painful, or just don't want to be bothered to learn will always find a Bash to pander to their wants. To each his own! But let's not throw the baby out with the bath water!

Henry S. Keen W5TRS
Fox AR

PROFESSIONAL RADIO

Wayne's answer to the letter concerning radio-theory testing requirements for amateur radio licensing (*73*, December, 1980) was "Let's hear it for the code-free, theory-free license." Such an attitude concerns me greatly.

I do agree with him in principal that code or theory really should not be a requirement, for as one will note, it is called "amateur" radio as opposed to "professional" radio. However, without the requirements we would be in serious trouble. Personally, I had a great deal of trouble passing the theory test (flunked it the first time), I am not capable of designing or repairing (unless very simple) my own equipment, I do not use the code that almost cost me my sanity to learn, yet I am a firm believer in those testing requirements.

I feel this way *not* because I think they make you a better radio operator, not because I think you should be able to fix your own gear (I envy those that can), nor because I think everyone should be a finger-talker, but because it is the only way I know of to date to keep amateur radio from becoming an expanded citizen-band radio.

I will be the first to admit that all the time I spent learning code and theory was a waste of time for I retained none of it; then, again, I feel the same way about the language requirement for my PhD—truly a waste of time, the only French I know today is *oui* (and that is because there is a magazine with that name). I feel that even though I did not choose electronics as my field, and at the same time have no desire to use CW, I do have a right to use the radio as does everyone. In addition, however, I feel that along with that right comes responsibility that must be taken seriously if I am to use this privilege.

Ten years ago I was also into CB. At that time I would say "This is KFK-1988 looking for __," and everyone used callsigns and proper radio procedure. There were a few who didn't take it seriously but we ignored them or asked that they use proper procedure. Slowly, their numbers increased until those of us that used our callsigns were in the minority and considered somewhat weird by the average CBer.

I cannot accept today's CB procedures nor do I want to search the deep abyss of my brain to come up with the world's greatest handle (and let's face it: The most important thing to a good CBer is the handle). Consequently, I have a box full of CB gear in my basement that has not felt a volt of electricity for ten years. Personally, I feel that perhaps they too have a right to the airwaves and if they choose to use a handle instead of a callsign, I can choose not to participate. In addition, it provides a place for the serious radio operator and the not-so-serious operator, each able to use the radio for their enjoyment—everyone has a choice.

Presently, the theory and code requirements are the only mechanisms that keep in check (with pretty good results) the professionalism of this amateur hobby. I know of no test that will scrutinize potential radio operators that would guarantee polite, professional, courteous, careful radio operators, and I recognize that the present system also allows a jackass to occasionally slip by the system.

I sympathize with those potentially fine radio operators that cannot pass that tests and therefore cannot give us the pleasure of their company on the bands. I can only say to keep trying, for we'll be waiting. However, if the FCC does away with the testing requirements, you and I both know what will happen and you and I will also be making a choice between selling our equipment or finding that super-unique handle (how about "Hambone"—seems appropriate).

So, until someone comes up with something better, let's not open the floodgates to the unprofessional, careless, unscrupulous, rude individuals who will turn a hobby that presently brings enjoyment into one which will bring frustrations and ulcers to us all. Amateur radio is still a hobby that generates friendships throughout the country, is considered a privilege, and approached professionally and seriously by 99.9% of its license holders—let's not jeopardize

(down-right lose) it by taking off all testing requirements until a better system is designed which will retain the high caliber it is today. What good would a license to operate be (even if very simple to acquire) if you wouldn't want to use it after you did obtain it?

Timothy W. Joseph WB8MIS
Plainfield IL

SHELL GAME

I hope you will print this letter and that your readers will be as burned as I am. It all started when I read David Sumner's (K1ZZ) "It Seems to Us" article in the December, 1980, *QST*. The more I read the more I felt I was participating in a fast-talking carnival shell game. You know, the old "now you see it—now you don't."

I read the K1ZZ article and the small print tucked away on page 51 of the September, 1980, *QST* five or six times before I got the whole picture. Judging from the letters in the Correspondence section of the December issue, complaining about the 25 kHz on the 40-meter band, many people completely missed the point. The rap occurred on the 20-meter band, but I will get to that later.

K1ZZ almost had me in tears of gratitude with the Board's concern for the ham's plight when the MUF drops below 14 MHz. But he explained that the new 10-MHz band gained at WARC would be the solution to that problem. Oh, joy!

Then he tells me that the Board recommended that this band (that was to be my salvation when the MUF dropped) be used only for CW and RTTY. Egad! What will the majority of the operating hams get out of this band? Nothing! The ARRL has ballyhooed us for months about the new band they gained for us at WARC (now you see it), then they turn right around and recommend restricting its use to CW and RTTY only (now you don't). All that talk about the MUF dropping below 14 MHz was just something to distract attention from the real issue, which is, how they are going to go about slicing the frequency pie.

But that's not all the Board did. The old shell game is just warming up. Since the CW and RTTY boys were handed the best band that was gained at WARC something must be done for the phone operators, right? Wrong!

Well, in all honesty, something was done for approximately 6% of the licensed hams, the Extra class operators. The Board recommended opening up the 7.075-7.100-MHz portion of the 40-meter band and the 14.150-14.200-MHz portion of the 20-meter band to the Extra class guys.

K1ZZ's article was strangely silent in regard to the 50 kHz on 20 meters that was handed over to the Extra class operators. Nor did his article mention that it was this 50 kHz that troubled the Board the most in deciding upon what to recommend. Who took care of the Extra class guys? According to my 1979 *Callbook*, the Board members are:

Name	License
Dannals	Extra
Anderson	Extra
Bieberman*	Extra
Butler	Extra
Carpenter	Advanced
Grauer	Extra
Holladay	Extra
Miller	Extra
Nathanson	Extra
Oubre	Extra
Stevens	Extra
Sullivan	Advanced
Thurston	General
Wangler	General
Wicker	Advanced
Zak	Advanced
Powell*	Canadian

*These board members voted against the resolution.

As you can see, 10 of the 17 board members are Extra class licensees, and they voted to take care of themselves. Don't be unduly grateful to Bieberman (W3KT) for his opposing vote. Apparently he opposed the resolution because his recommendation on how to slice the pie failed. Incidentally, his recommendation opposed giving the General and Advanced class operators the paltry 25 kHz on 20 meters that they did get.

The only board member deserving of any respect is Powell (VE3OT). At least he voted in the best interest of the hams he was representing. We all know it would be in his best interest to keep stateside calls out of the band below 14.2 MHz.

OK, it's time to give you the score, the net effect of the Board's recommendation. If you tried to decipher this from *QST* you would need a magnifying glass and a flowchart to know the outcome. Here are the results complete with the winners and losers.

For Generals, Advanced, and Extras, RTTY and CW will be OK on 10.100-10.150 MHz, a gain of 50 kHz.

Extras only: 7.075-7.100 MHz (25 kHz) and 14.150-14.200 MHz (50 kHz).

Advanced ops in the 14.175-14.200-MHz range get 25 kHz.

Generals: 14.225-14.250 MHz (25 kHz).

The only real winners are the Extra class operators. They gained an additional 75 kHz on phone. I can't argue with the fellow who studies and passes the Extra class exam and as a result gets rewarded with extra privileges. But in this case, the Extras did nothing to earn the 75 kHz. For the same effort, the Generals and Advanced class licensees got only 25 kHz. The 25 kHz are an insult to one's pride and intelligence. It's like pitching a steak bone to a dog.

Based upon the license class statistics in my 1979 *Callbook*, the losers (Generals and Advanced) represent about 51 percent of the licensed hams. I wonder how long the ARRL would survive if it retained only its 6% favored membership?

No doubt about it: The CW operators are losers also. They swapped 75 kHz on 20 and 40 meters for 50 kHz on a band where they don't have any equipment or antennas.

Another big loser is the Advanced class DXer. If you don't believe me, just check your log and notice how many of the really rare countries you bagged on the bottom 25 kHz of 20 meters. The crowded conditions will again push the rare DX to the lower end of 20 which will be out of the Advanced class operators' reach.

I suppose what bothers me most is that I feel like I have been had. The Board feels free to dictate and to manipulate its own ARRL members. They expect me to swallow K1ZZ's snow job. They think they can force the CW operators to move, too, and to open up the new 10-MHz band for them. They think they can force hams to upgrade to Extra by penalizing them 50 kHz. They expect people like me to keep their mouths shut. Well, I've got news for them. I'll upgrade when I get damn good and ready to do so—and I will not keep my mouth shut.

Robert G. Ray WB4TCH
Germantown IN

Picky, picky, picky. —Wayne.

REMEMBERING WHEN

In the December, 1980, issue of *73 Magazine*, I was fanning through in preparation to reading it when two names jumped out at me, MacKinlay Kantor and Bandel Linn. I had the good fortune to meet both in Sarasota back in 1954 and 1955 when I worked for Kent McCinley (*The Sarasota News*). Kent asked me to come down and set up a darkroom and photographic staff and Bandel was doing the cartoons for the *News*.

The first time I met him was a bitter cold morning. The City Editor wanted a shot of the official thermometer over on Midnite Key and I had to go by Bandel's and get him out of the sack because the Editor wanted a snowbird drawn sitting on top

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of the louvered cabinet that housed the official thermometer. Bandel's first words were "I dunno what the hell a snowbird looks like."

I met MacKinlay Kantor the first time at the post office where I had been sent to get a shot of him mailing the manuscript to the publisher on a Monday morning. It was later the next year that he won the Pulitzer Prize for that manuscript, *Andersonville*. We became good friends and I used to drop in at his place every time I was over at the beach on an assignment.

We talked about Spain a great deal as I had at one time rented a house in a little village and thought I could loaf for a whole year. But after a month and a half, I was going nuts so I had the agent sub-lease it and I came back to the states.

My tenant was Mac Kantor. We used to get a big laugh out of it. He told Johnny, who owned the Beach Club, that I was a hell of a landlord and wouldn't fix the pipes, but where else could he rent a six-room house on the beach. A house that housed Hemingway, Michener, and myself. Where else could he find a house with all that room and two servants all for fifty dollars a month, and keep a dog, Lobo.

One of the most touching obits I have ever heard was the one Mac wrote when Lobo died. Mac loved that dog.

I met a number of interesting people at Mac's home: Ben Stahl, the artist, had a beautiful home on the key and I did a spread for *House Beautiful* on it. He bulldozed a hill and built the house with a basement—unheard of in Florida those days. There was a *john* in the basement! When you closed the door, a panel on the right-hand wall slid up and a bar with a small refrigerator below was at your elbow.

Another person I met at Mac's was a folk singer with a guitar—Burl Ives.

I left Sarasota and moved to Miami where I lived until I had to have my leg amputated (bad circulation) and then moved to Riverview, a small town south of Brandon which is a small town south of Tampa.

Bob McConnell
Riverview FL

RTTY LOOP

from page 18

tional cassette recorder. The unfortunate side is that no compatible tape system is used for these tapes. So, owners of large 6800 systems cannot assemble programs on the large system, dump them to tape and load that tape into the ATR-6800. They are forced either to figure out some direct way of loading or to type in programs by hand, which is very tedious for long programs.

So, let's see what we have. The Microlog ATR-6800 is a versatile computer-based (Motorola 6800) RTTY/Morse system capable of operating on Baudot, ASCII, or Morse. Enhancement programs are available to add convenience functions in the standard modes, or to add additional modes, namely, transmission of SSTV (reception is not supported). Used on Baudot RTTY, probably the most likely application, the unit can provide good solid communication, once familiarity with the unit is obtained. Other modes can be run with ease equal to Baudot, and operation is similar, no matter what the mode.

Problems? Well, putting the functions on the keycaps would help the learning process immensely. Tuning is marginal with the provided indicator; two LEDs for Mark and Space would make tuning less of a chore. The display size is a function of the amount of RAM dedicated to the video display; nonetheless, forty characters on RTTY is a bit more than half of a standard RTTY line, and any attempt at formatting is useless. A hard-copy printer is probably still needed for any type of message or novelty work; this may be one of the new ASCII printers, however, and need not be an old green-key-greaser. The character generator could be changed to a more standard type, and perhaps another software function provided to switch the keyboard into conventional lowercase unshifted, uppercase shifted format in ASCII.

Overall, it's a good unit, but I don't think it is the end of the line. Microlog is actively working on new options and features, as are many other manufacturers. I think we all need to keep our eyes open—it can only get better.

We will catch up on some reader input next month, and take a look at more equipment useful to the RTTYer as time goes by. Questions about RTTY? Even if we covered it a few years ago, you may have missed it. Let me know what you need to find out, and look for the answer here in RTTY Loop.

CNTRL-A	Exit from Computer Mode	CNTRL-Z	Zoom/normal toggle
CNTRL-B	Cassette Tape Play/Record	CNTRL-0	Select number of char per line
CNTRL-C	Send clock time	CNTRL-1	Demodulator toggle
CNTRL-D	SYNC (diddle) on/off	CNTRL-2	Hi/low tone toggle
CNTRL-E	Computer terminal mode	CNTRL-3	Normal/inverted toggle
CNTRL-F	Ignore received line feed code	CNTRL-4	AGC toggle
CNTRL-G	Anti-CW toggle	CNTRL-9	Printer char line length
CNTRL-H	Select MARK/SPACE frequencies	CNTRL-SPC	Morse intercharacter spacing
CNTRL-J	Half-Full duplex select	CNTRL-SK	Receive mode
CNTRL-K	Set clock	CNTRL-KN	Receive mode, clear buffer
CNTRL-L	Line Mode, on/off toggle	CNTRL-AR	Word wrap toggle
CNTRL-M	Morse mode	CNTRL-.	Memory size
CNTRL-N	Printer enable/disable toggle	CNTRL-TAB	Display system status
CNTRL-O	Enter Computer Mode	CNTRL-ESC	Re-initialize display
CNTRL-P	Printer speed select	CNTRL-+	Extend STOP bit
CNTRL-S	Split screen line position	CNTRL-BK	Transmit mode, save buffer
CNTRL-T	RTTY Mode	SHIFT-KN	Transmit mode
CNTRL-U	Unshift on space toggle	SHIFT-AR	Receive when buffer empty
CNTRL-V	Black/white display toggle	SHIFT-0	Morse when buffer empty
CNTRL-W	Word mode, on/off toggle	SHIFT-BT	RTTY when buffer empty
CNTRL-X	Select operating speed		
CNTRL-Y	Keying relay toggle	...and many more...	

Fig. 2. ATR-6800 keyboard commands.

HAM HELP

I recently obtained a Trio 9R59D general-coverage communications receiver, but no schematic or service manual was available from the previous owner. I will gladly pay for photocopies or an original manual. This receiver was manufactured in the 60s and sold by Simpsons-Sears in Canada. Thank you.

F. G. Clark Forrest VE3BOF
102 Richmond St. N.
Hensall, Ontario
Canada N0M 1X0

I need two things. First, a schematic for a Knight C-577 speech compressor. Second, a schematic/manual for a signal monitor, Model SM7403, made by Defense Electronics, Inc., of Rockville MD. Most important, I need to know what i-f frequency the signal monitor operates with. Without that, I cannot use it!

Any costs for schematics/manuals or copies thereof will be happily reimbursed. Please notify me of what you have.

SSG Gary E. Kohtala WA7NTF
Qtrs 772D, Shiloh St.
Ft. Devens MA 01433
(617)-772-0395

CONTESTS

from page 14

BARTG SPRING RTTY CONTEST

0200 GMT March 21 to 0200 GMT March 23

The total contest period is 48 hours but not more than 30 hours of operation is permitted. Time spent as listening counts as operating time. The 18 hours of non-operating time can be taken at any time during the contest but off-periods may not be less than 3 hours at a time. Times on the air must be summarized on the summary sheet. There are separate categories for single-operators, multi-operator, and shortwave listener stations. Use all amateur bands from 80 through 10 meters. Stations may not be contacted more than once on any one band.

EXCHANGE:

The message exchange consists of 1) time in GMT; this must consist of a full four-figure group and the use of the expression "same" or "same as yours" will not be acceptable. 2) RST and message number; the message must consist of a three-figure group starting with 001 for the first contact made.

SCORING:

All two-way RTTY contacts with other stations within one's own country earn two points; those contacts outside your country are worth ten points. All stations can claim a bonus of 200 points for each country worked, including their own. Note that any one country may be counted again if worked on a different band, but continents are counted once only. The ARRL country list is used and, in addition, each W/K, VE/VO, and VK call area will be counted as a separate country. Final score is sum of QSO points times the total number of countries worked added to the number of countries times 200 bonus points each times the number of continents. Note, proof of contact will be required in cases where the station worked does not appear in any other contest log received or the station worked does not submit a check log.

AWARDS:

Certificates will be awarded to the leading stations in each of the three classes, the top station in each continent, and to the top station in each W/K, VE/VO, and VK area. If a contestant manages to contact 25 or more different countries on two-way RTTY during the contest, a claim may be made for the Quarter Century Award (QCA) issued by BARTG and for which a charge of $3.00 (USA) or 15 IRCs is made. Make your claim at the same time you send in your log. Holders of existing QCA awards will automatically have new countries added to their records. However, due to the high volume of work, it will not be possible to prepare and dispatch any new awards or update any existing awards until the final results of the contest have been evaluated and published.

Additionally, if any contestant manages to contact stations on two-way RTTY with each of the six continents and BARTG Contest Manager has received either a contest or check log from each of the six stations concerned, a claim may be made for the WAC Award issued by the American *RTTY Journal*. The necessary information will be sent to the *Journal*, which will issue the WAC Award free of charge.

ENTRIES:

Use a separate sheet for each band and indicate all times on the air. Logs should contain: date/time in GMT, callsign of station worked, RST and message number sent, time, RST and number received, and points claimed. Logs received from shortwave listeners *must* contain both the full report sent and received by the station logged. Incomplete loggings are not eligible for scoring. The summary sheet should show the full scoring, the times on the air, and in the case of multi-operator stations, the names and callsigns of all operators involved with the operation of the station. All logs must be received by May 31, 1981, in order to qualify. Summary and log sheets are available from the Contest Manager at the address shown below. The judges' decision will be final and no correspondence can be entered into, in respect of incorrect or late entries, and all logs submitted will remain the property of the British Amateur Radio Teleprinter Group. Send entries to: Ted Double G8CDW, 89 Linden Gardens, Enfield, Middlesex England EN1 4DX.

TENNESSEE QSO PARTY

2100 GMT March 21 to 0500 GMT March 22
1400 to 2200 GMT March 22

This is the 11th annual QSO party sponsored by the Tennessee Council of ARC. You may work the same station on different bands, modes, or counties. Repeater contacts are not allowed. Mobiles compete against mobiles, portables against portables. Single-transmitter entries only, please. No county-line operations allowed for multiple contacts. Portable stations must set up per Field Day rules. No "list" operations are allowed.

EXCHANGE:

Signal report and state, province, country, or TN county.

SCORING:

Score one point per phone QSO; two points per CW QSO on 80, 1.5 points on other bands. Combine phone and CW score as one contest. TN stations multiply QSO points by sum of number of different states, TN counties, and VE/VO provinces. All others multiply QSO points by the number of different TN counties worked. For stations working outside their home TN county, score 200 bonus points for each county with a minimum of 10 QSOs. A power bonus multiplier of 1.5 is available to all stations operating at 200 Watts dc or less during the entire contest period.

FREQUENCIES:

Phone—3980, 7280, 14280, 21380, 28580.

CW—approx. 50 kHz up from bottom of each band, Novices within their bands.

AWARDS:

Plaque to TN winner, TN mobile, and portable, plus out-of-state winners. Certificates with complete contest summary to every station sending in logs with at least 15 contacts.

ENTRIES:

Logs must show date/time in GMT, station worked, band, mode, exchange, and score. Use separate log sheets for each band with over 50 contacts. Submit a cross-check sheet similar to ARRL CD77 if over 200 QSOs are made. Logs must be legible to avoid disqualification. Logs must be mailed by May 1, 1981, to: Dave Goggio W4OGG, 1419 Favell Dr., Memphis TN 38116. Please include a business-sized SASE with your logs.

CARF PHONE COMMONWEALTH CONTEST

1200 GMT March 21 to 1200 GMT March 22

This contest is sponsored by the Canadian Amateur Radio Federation (CARF) and is open to all radio amateurs licensed to operate within the Commonwealth or British Mandated Territories. Operators may use the entire 24-hour contest period. All contacts must be made on SSB using 80 through 10 meters. Only one contact may be made with any station using a Commonwealth callsign except those within the entrant's own call area. UK stations may not work each other for points.

EXCHANGE:

RS report and a three-figure serial number commencing with 001 and increasing by one for each successive contact in the contest period, irrespective of the band in use. Each exchange must be acknowledged by the receiving station.

FREQUENCIES:

Suggested frequencies are a plus or minus 20 kHz of 3600, 3780, 7080, 14180, 21200, 28480.

SCORING:

Each completed contact scores five points. Additionally, a bonus score of 20 points may be claimed for the first, second, and third contacts with each Commonwealth call area on each band. All UK stations count as one call area.

ENTRIES:

Entries may be single- or multiband. Single-band entries should show contacts on one band only; details of contacts made on other bands should be enclosed separately for checking purposes. Only single-operator entries will be accepted. A single-operator station is

one manned by an individual who received no assistance whatsoever during the contest period. Multiband entries will not be eligible for single-band awards. Points are deducted for errors in the logs. For unmarked duplicate contacts for which points have been claimed, additional penalty points may be deducted. Each entry will consist of the separate band logs, including call area check lists, a summary sheet, and dupe check sheets. Each entry must also be accompanied by a signed declaration that the spirit and rules of the contest were observed, as well as the terms of the contestant's license. Entries should be addressed to: CARF Contests and Awards Committee, PO Box 2172, Station D, Ottawa, Ontario, K1P 5W4 Canada. Under no circumstances should entries be sent via RSGB. The closing date for entries is June 1, 1981.

SPRING VHF QSO PARTY

1800 GMT March 28 to 0400 GMT March 30

Sponsored by the Ramapo Mountain ARC. The contest rules are the same as for the ARRL VHF QSO Parties except FM operation is not permitted below 450 MHz.

EXCHANGE:

Signal report and ARRL section.

SCORING:

One QSO point for 50- to 144-MHz contacts, 2 points for 220- to 430-MHz contacts, and 3 points for 1215 MHz and up. Multiply QSO points by the sum of ARRL sections per band.

ENTRIES:

Use the ARRL VHF QSO Party or similar forms, or send an SASE to RMARC for entry forms. All who submit entries will receive a copy of the results. Mail entries by April 27, 1981, to: Ramapo Mountain ARC, PO Box 364, Oakland NJ 07436.

YL ISSB QSO PARTY—CW

0001 GMT March 28 to 2359 GMT March 29

Two six-hour rest periods are required. Operating categories include: single-operator, DX/WK teams, and YL/OM teams. All bands will be used and the same station may be contacted on different bands for contact points but not as country multipliers. All contacts, however, must be made outside the American phone bands. Two meters may be used, but contacts must be direct and not through repeaters.

EXCHANGE:

Name, RST, SSB'er number, country, state, and partner's call. If no partner, leave blank. If non-member, send "no number."

FREQUENCIES:

3665, 7070, 14070, 21070.

SCORING:

Score eight points for each member contacted on any continent. Non-member contacts count one point. Only member station contacts count for multipliers. Multipliers are each state, country, and province, also, each team contacted, but only once for each team. When DX/WK partners contact each other, it counts as a double multiplier. Final score is sum of QSO points times the total multiplier.

AWARDS:

Extraordinary certificates will be issued to the highest individual score, DX/WK teams, YL/OM teams, and score for highest single-operator category. Regular certificates to the highest state, country, and Canadian province winners.

ENTRIES:

Logs must show date/time (GMT), RST, SSB'er number, partner's call, mode of operation, band, and period of rest time. Summary sheets show number of states, Canadian provinces, countries, YL/OM teams, DX/WK teams, and partner contacts. All entries must be postmarked by May 15, 1981.

Any member desiring to enter the DX/WK Team category should immediately send request to Lyle F. Shaw KC4LF, 6329 Fairway Blvd., Apollo Beach FL 33570. For record purposes, requests should be made in writing. In the week preceding the QSO party, members desiring a partner may request one through system controls on SSB'ers daily systems. No team assignments will be made after the party begins.

YL/OM teams are self-evident in their operation and need not file. Single-operator category members are eligible unless entered with teams. Non-members enter single op only! DX/WK teams consists of a DX and WK member. The team score is the sum of both partners. Score to be determined when both logs are received. When only one log is received, credit will be given as a single-operator. YL/OM teams consist of one YL member and one OM member who are related: husband/wife, father/daughter, mother/son, and brother/sister. Operation must be from the same QTH, using the rig with his/her own call.

WORLD RTTY CHAMPIONSHIP

The IATG Radiocommmunications and CD publications are again sponsoring a series of contests for RTTYers on all continents. The purpose of the contest is not only to increase interest among radio amateurs for RTTY, but also to promote interest in long-range contacts. That is, to stress intercontinental contacts rather than domestic contacts as in previous contests. For this purpose, IATG and CD have organized three contests during the year. The first was back in January but information was received too late for publication. The remaining contests are the North and South American RTTY Flash Contest this month and the Europe and Africa RTTY Giant Flash Contest in May.

For each of the three contests there will be a general winner plus a winner from each of the two continents involved. Separate standings for each continent plus a general standing for each contest, will be published in various magazines. Points for the overall championship will be awarded as follows:

For contest winners—First place, 50 points; Second, 46 points; Third, 43 points; Fourth, 41 points; Etc. to 44th, 1 point.

For continental winners—First place, 25 points; Second, 22 points; Third, 20 points; Fourth, 18 points; Fifth, 17 points; Etc. to 21st, 1 point.

Standings are independent, continental winners can also be general winners.

At the end of the three contests, continental and general standing points will be totaled and a World Champion of the Five Continents will be declared according to the new final standing obtained. Prizes as usual are awarded for the four first-place winners. Consolation prizes will also be awarded.

NORTH AND SOUTH AMERICA RTTY FLASH

1800 GMT March 28 to 0200 GMT March 29
1200 to 2400 GMT March 29

The points and multipliers are awarded in a manner to encourage long-range contacts, which are an indication of the operator's ability and the efficiency of his equipment. The contest committee is open for suggestions or constructive criticism which will be considered for the rules for future contests. They are especially interested in suggestions as to what regulation they might incorporate in future contests to encourage the use of home-made microprocessor and/or programming on commercially available equipment in RTTY. Use all bands from 80 to 10 meters. Operating classes include single- and multi-operator with single transmitter plus SWLs. Each station may be contacted only once on any one band. Remember that all contacts must be on RTTY!

EXCHANGE;

RST, QSO number, and your continent.

SCORING:

QSO points are earned as follows: QSO on 80 or 40 meters—2 points; 20—3 points; 15—6 points; 10—8 points. No points or multipliers for contacts with one's own country. Only two-way RTTY contacts are valid.

Multipliers are given for countries and continents. Use the DXCC country list, plus count each call area of VE/VO, W/K, VK, PY, LU, JA, and UA0/9 as separate countries. A multiplier is given for each country worked on the 20 through 10 meters. *No* multipliers for contacts on 80 or 40 meters with one's own continent. A separate multiplier may be claimed for the same country if a different band is used (maximum of 3 times). Only countries which appear in at least 3 other logs will be valid multipliers, unless a QSL confirmation is submitted. One's own country is not valid as a multiplier. For contacts with North and South America, both the sender and the receiver will receive 100 points as a multiplier. Each of the remaining continents receive 50 points. An additional 100 points will be given for each contact with North and South America on 15 or 10 meters.

The final score is the total QSO points times the total number of countries times the total number of continents plus the total points for NA and SA stations worked. Example: 600 QSO points times 10 countries worked times 100 continent points equals 600,000, plus 20 stations of NA and SA worked on 15-10 meters gives a grand total of 602,000 points.

Attention! Two promotional periods are included in the contest: 1900 to 2000 GMT March 28 and 1200 to 1400 GMT March 29. Stations operating from Europe, Africa, Australia-Oceania, and Asia contacting NA and SA during these hours will *double* their points for these periods.

Beginner handicaps are offered to RTTYers entering logs in the contest who have not participated in previous contests. They will receive an additional 5% of their final score. Additional handicaps offered are 10% of the total final score of the winner of previous RTTY Championships or 8% of the total final score for the winner of one or more preceding RTTY contests. SWLs also may enter and they should use the same scoring rules. A separate results table will be made for these entries.

AWARDS:

Prizes, as usual, are reserved for the four first-place winners. Consolation prizes will also be awarded.

ENTRIES:

Use separate log sheets for each band. Logs must contain date/time in GMT, callsign, RST and QSO number sent/received, country and continent multipliers, points, and final score. The contest disqualification criteria used by the ARRL in its contests apply also to this contest. Failure to observe any rules will result in exclusion of the entry for the final results and any such log will be considered as a check log. Logs compiling errors exceding 10% of the final score will also be excluded from the final standing. Each log received becomes the property of the IATG Radiocommunications and will not be returned. The decision of the organizing committee in any dispute will be final and any subsequent controversy may not be referred to the civil court. Remember that the contest is valid towards the final standing of the 5-Continent World Championship.

In order to qualify, all logs must be received no later than April 30, 1981. Send logs to: Prof. Franco Fanti, Via A. Dallolio n 19, Bologna 40139 Italy.

AWARDS

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managers of this new service? Meet Laryl Myers N7BMY who is the General Manager. She is relatively new to amateur radio but is already a dedicated brass-pounder— when she finds time. She has an extensive background in filing system management. It took Laryl only two weeks to learn the code and theory for her Technician license and then another two weeks after her ticket arrived to upgrade to General. She has definite goals of attaining 60 wpm on CW and indicates she will be an Extra someday soon! Jokingly, Laryl expresses regret that she doesn't expect to be on the phone bands for some time to come.

As for her counterpart, Laryl's assistant manager is Pat Berry KB7JW. Pat was first licensed in 1962 as K7SGX. He is strictly a CW operator who takes pride in working high-speed rag-chews, So far, his longest QSO has been 24½ hours continuous, but he hopes someday to top that time. Low end of 80 meters, anyone?

How do you use the service? It's all relatively simple. Keep at least two, preferably three, legal sized SASEs on file with the service at all times. Make sure they contain the current amount of first-class postage. Place your callsign in large block letters in the upper left-hand corner and in the middle of the flap on the back of your SASE. When you receive one of your SASEs, send another one to replace it. Don't forget your outgoing QSLs that you owe people. The service needs them to stuff waiting envelopes of the people you've had a QSO with.

To send cards into the outgoing bureau, pre-sort them in alphabetical order by call area. Place no more than 20 in each envelope, along with your 25¢ handling fee. Make sure you place proper postage on your envelope as the service cannot accept postage-due material. Address your cards to: US QSL Service, PO Box 814, Mulino OR 97042.

SIX-METER CROSSBAND AWARD

Sponsored by the Society for the Preservation and Encouragement of Six Meters, this new Crossband Award is awarded in acknowledgement of attaining two or more DX contacts made via six-to-ten meters crossband.

For those not familiar with crossband operation, this particular procedure becomes necessary for a good many European operators whose countries do not allow six-meter transmission due to commercial broadcasting frequencies being subjected to interference. To satisfy both the government needs as well as the wants and wishes of many European six-meter enthusiasts, a crossband effort has proven to be extremely effective and ever increasingly popular.

To apply for this award or to obtain more information about this society, write Armin Montavon WB9OVC, SPESM Secretary, PO Box 268, S. Elgin IL 60177. The cost of the award is $1.00 to cover the postage and handling.

For those award seekers interested in specialized communications, let's review a couple of video awards being offered for SSTV and ATV respectively.

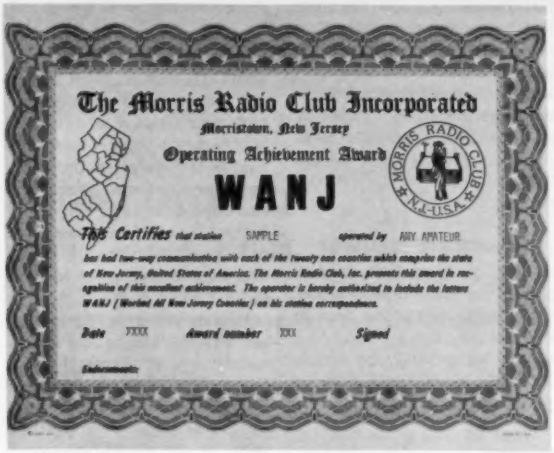
10-METER SSTV NET AWARD

There is a very successful SSTV-Video Net taking place each Saturday at 1800 GMT on 28.680 MHz. An average of 30 stations have been checking in with various interests in SSTV transmissions. To those who make 3 SSTV Net Check-ins, a very special Net Award certificate will be issued. For more details, why not check into the net or write one of the founders of the net? Contact Mike Stone WB0QCD, PO Box H, Lowden IA 52255.

ATV MASTER SCANNERS AWARD

Henry Ruh WB9WWM, publisher of *ATV Magazine*, has written and provided me with details of their Master Scanner Award. The award has various levels of operating achievement: work 5 stations on each of 5 bands, 6 stations on each of 6 bands, 7 stations on each of 7 bands, 8 stations on each of 8 bands, 9 stations on each of 9 bands, and 10 stations on each of 10 bands, or work 25 stations on 10 meters, 10 stations on 6 meters, or 10 stations on any band above 144 MHz.

Only contacts made after August 1, 1978, count toward this award. Submit your verified list of contacts with a $1.00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Date XXXX Award number XXX Signed
Endorsements

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the little bay award
The L'ANSE CREUSE AMATEUR RADIO CLUB "LITTLE BAY" award
Presented to SAMPLE for successfully contacting
10 members of the club with the C.W. or S.S.B. mode of transmission.
signed President

award fee to Master Scanner Award, PO Box 1347, Bloomington IN 47402.

WORKED ALL NEW JERSEY AWARD

The original Worked All New Jersey Award certificate is again being offered by the Morris Radio Club to all amateurs having established contact with all 21 New Jersey counties. There are no specific modes or bands required but endorsements will be granted for single band or mode accomplishments.

To apply, have your list of 21 counties verified by at least two amateurs or a radio club secretary. Forward this list along with an award fee of $2.00 to: Morris Radio Club, PO Box 53, Whippany NJ 07981.

100 CCXX AWARD

To the many (220-MHz) operators who read this column, the *220 NOTES* of the metropolitan Chicago area have an awards program designed expressly for you.

An attractive certificate is awarded to amateur radio operators who contact a minimum of 100 separate stations anywhere on the 220-MHz band, through a repeater or simplex.

To apply, prepare your list of contacts in order of date and time (GMT) worked. Have this list verified by at least two amateurs or a radio club secretary. Forward this application along with an award fee of $1.00 to: *220 NOTES*, Greg Pietrucha WB9SNZ, 2216 N. Kildare Avenue, Chicago IL 60639.

THE LITTLE BAY AWARD

This seems to be the month for amateur radio clubs. We hope other organizations will take the hint and submit their own awards as the L'Anse Creuse Amateur Radio Club has done. Here we announce their Little Bay Award.

Applicants need to confirm contact with 10 individual members from the radio club. DX stations require only 3 member contacts. A list of members and actual frequencies they monitor may be obtained by writing Ted Bak WB8ZME, 35751 Dunston, Sterling Heights MI 48077.

Once you have established the required contacts and obtained confirmation, submit your list to Ted along with an award fee of $1.00 to cover postage and handling.

WORKED ALL VERMONT AWARD

The Central Vermont Amateur Radio Club wishes to announce that it has once again reactivated the Worked All Vermont Operator Award.

To qualify for this award program, applicants must work 13 of the 14 counties of the state of Vermont. Applicants may utilize any band or mode or any combination thereof, with the exception of repeater operation. There are no time limitations.

To apply, prepare a list of qualifying contacts and have it verified by at least two amateurs or by a local radio club official. Send this list with an award fee of $2.00 to: Central Vermont Amateur Radio Club, c/o Grant Taylor, RFD #1, Box 150, Cabot VT 05647.

FCC

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would be able to make the call lawfully because then two amateur radio stations would be involved. No such convoluted rationale underlies the provisions of § 97.79(d). On its face, § 97.79(d) gives discretion to an amateur operator to allow a non-licensed person (i.e. a third party) to engage in communications using his transmitter, under proper monitoring conditions and supervision by the licensee. We concur with the staff's view that this refers to two-way communications. To say that this would preclude the licensed operator himself, as control operator, from using his own station to make a phonepatch strains credulity and we reject the inference that petitioner draws from its hypothetical situation.

10. Appealing on an equity basis, petitioner avers that under our interpretation of the rule, model aircraft enthusiasts who are not yet licensed amateur operators will be deprived of exposure to amateur radio activity because they are not permitted to control the aircraft by operating the amateur radio transmitter. We reject this argument for the reason that the person who truly has an avid interest in amateur radio has a myriad number of opportunities to advance his interest and to acquire proficiency in the art and hobby of amateur radio. In fact, it is quite probable that the model airplane enthusiast's major interest is in model airplanes, not radio.

11. We believe that any need for more channels for control of model aircraft should be met in the Radio Control Radio Service. In this connection, it is noted that AMA has a petition for rulemaking (RM-3248) currently on file with the Commission which asks for such additional frequencies.

12. In summary, we believe that it would be contrary to the public interest to permit a person who is not a licensed amateur radio operator to operate an amateur radio station to control a model aircraft. For all of the foregoing reasons, the interpretation of § 97.79(d) made by the Commission's staff is hereby affirmed.

Federal Communications Commission.
William J. Tricarico,
Secretary.
[FR Doc. 80-37578 Filed 12-2-80; 8:45 am]

HAM HELP

I would like to obtain information on connecting an FSK/AFSK unit to use with a Macrotronics M-80 (M-800) ham interface (TRS-80) in conjunction with a Kenwood TS-520. Any type of information is appreciated. All inquiries will be answered!!

James Gonsalves, Sr.
2257 Manhattan Place
Santa Clara CA 95051

I need the current address of Omega-T Systems, or a repair facility for the Omega-T antenna noise bridge, Model TE-01. The company is no longer receiving mail at 516 W. Belt Line Rd., Richardson TX. My bridge generates noise but will not null, even into a dummy load.

Bill Koczon W2HWQ
85 Lakeland Drive
Brick Town NJ 08723

W2NSD/1
NEVER SAY DIE
editorial by Wayne Green

from page 8

ais to work with, only the organization to make use of them is lacking.

The obvious thing then is to make a trip to Africa, sit down with the leaders of these countries and make them aware of the fantastic resource they have at hand and are not using. Unfortunately, the obvious is not always the best approach... and I guess that holds particularly with the Third World nations.

The weakness of the idea lies in the leaders, who are for the most part occupied largely with staying leaders. Just as the first item of business for an elected official in the US is to get started with his reelection campaign, the bulk of the effort for an African leader is in staying alive and in control. It is a fight for most of them and as a result they are far too busy to really consider matters of benefit to their countries.

Remember, if you will, my writing about the fear that most African governments have of personal communications. A leader who is having to fight daily to stay in power is going to have very little interest in the introduction of low-cost, portable personal communications. He'll rightly think that this will be an invitation for his foes and for terrorists to set up their communications for the purpose of doing him in. This is why the ARRL miniature transistor rigs were so completely rejected. Not that that has been much of a problem, for as far as I know most of these rigs have been either stolen or "mislaid" right here in the US and the whole project a disaster which the ARRL would prefer to cover up.

Visiting hams do not present any perceived danger to these African governments, so our DX-peditions are able to visit and operate from many of these countries. But when it comes to organizing anything in the way of communications for their citizens, that's another matter. The fact is that one is hard put to point to any African nation which appears stable at this time. I've visited a number of them and am getting letters from hams in others, so I'm keeping on top of the situation fairly well. You may be sure that if I see a good opportunity to visit a country with the expectation that I might succeed in getting amateur radio set up, I will be on the next jet.

In the meanwhile, we should be laying the groundwork for this. It *is* important that some representative of amateur radio reach the heads of the African countries and explain about amateur radio. While little may be possible right now, the stage can be set for something later on. The time just might come when the leader of a country is well enough established so he will have the luxury of starting some long-range plans to benefit his country. I hope we are there at that time...with our homework done.

THINKING OF WRITING?

While our top priority for articles is on state-of-the-art construction projects, the fact is that virtually every one of you has at least one good article bottled up in you, just waiting to get into print.

What do *you* enjoy reading about? Well, most other readers are just the same as you...so give some serious thought to having at a typewriter and getting into print.

If you're doing any kind of original designing and construction, be sure that you document every step so that you can help others to enjoy what you've done. Sure, you'll get paid for the article...and you'll hear about it from just about everyone you contact on the air or at clubs. Authors achieve a sort of instant stardom which is remembered for an amazingly long time.

If you're not into building, perhaps you've done some other things which would be of interest...a DXpedition...or even some interesting perspective on everyday hamming. When is the last time you read something interesting about traffic handling? About repeaters? DXing? Or even some idea which might help rag chewers...and heaven knows rag chewers need help more than any other group.

Have you been running some Novice classes and thus have some ideas which might help us get more hams? Or has your club come up with a project which might spark others into similar cooperative projects? Perhaps you know a ham who has done an outstanding job of helping others, organizing a net, or other work which would be of interest and inspiration to all of us?

How do you write? Simple... use a typewriter, double space, leaving generous margins for editing, send in hand-drawn sketches of circuits and the best photos you can manage. *73* pays for all material accepted for publication, unlike other magazines which either do not pay at all...or else may pay upon publication, which can be months later. Many hams, whose names you see often in print, are making their hobby pay very well for them...and in addition are getting the satisfaction of providing pleasure and inspiration for about 150,000 *73 Magazine* readers.

(Send for "How To Write For *73*" – just drop a card to Editorial Offices, *73 Magazine*, at the address below.)

As an author, you certainly want to get the top dollar for your work, not just give it away. You also want it to be read by the widest possible readership. This means you should get it to *73* for publication. Our technical staff will look it over and get back to you within several weeks and let you know if it has been accepted (along with a check). Or they may ask for some changes or additions... or even reject it. You still have three more ham magazine which are hungry for articles, so your chances of not being published at all are remote.

73, which publishes the most articles of all the ham magazines...and which reaches the active and enthusiastic hams ...is your best bet. Is that boast of publishing the most articles just smoke or is it fact? You can count 'em yourself. During 1980, *73 Magazine* published 290 feature articles. In the same time period, *QST*, the next largest ham magazine, published 142 articles...less than half as many.

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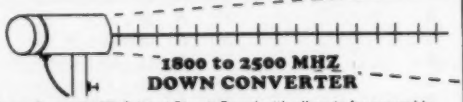

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What are hams *really* like? Have you, like many of us, ever pondered this question? What is it that draws people into amateur radio rather than, say, stamp collecting?

This month, we're setting aside the usual crossword, acrostic, matching, and other puzzles, and replacing them with something different. Something, we hope, that will be just as enjoyable as any puzzle to complete. What follows is a poll—a survey—that will tell us something about ourselves, who we are and why we do what we do.

This is not a scientific survey. For it to be such, we would have to solicit responses from a carefully selected cross section of hams. Instead, what we hope to gather are the random responses of readers of this column. A collection of the gut feelings of amateurs as they answer questions ranging from their personal life-styles to how they view emerging trends in our hobby.

So, please take the time to fill out the responses and mail them back to the address at the top of this column. If you don't want to cut up the magazine, photocopies are fine. You will note that there is no place on the form for your name, address, or call—this is an anonymous survey and we really don't want to know who you are, just what you think! In a few months, we'll be printing and analyzing the responses, and the results should be, to say the least, interesting. Have FUN!

ELEMENT 1—BACKGROUND

1) Sex:
   - A) Male
   - B) Female

2) Age:
   - A) 15 or below
   - B) 16–21
   - C) 22–39
   - D) 40–59
   - E) 60 and above

3) License class:
   - A) Novice
   - B) Technician
   - C) General
   - D) Advanced
   - E) Extra

4) Number of years licensed:
   - A) 1 year or less
   - B) 1–5 years
   - C) 6–10 years
   - D) 11–20 years
   - E) 21 years and up

5) Do you have a new (post-March '78) call?
   - A) Yes
   - B) No

6) How many hours a week do you devote to amateur radio?
   - A) 0–1 hour
   - B) 2–5 hours
   - C) 6–10 hours
   - D) 11–20 hours
   - E) 21 or more hours

7) Which HF band do you use most?
   - A) 80–75 meters
   - B) 40 meters
   - C) 20 meters
   - D) 15 and/or 10 meters
   - E) Don't operate HF

8) Which VHF-UHF band do you use most?
   - A) 6 meters
   - B) 2 meters
   - C) 220 MHz
   - D) 420 MHz and/or up
   - E) Don't operate VHF-UHF

9) Which mode do you use most?
   - A) SSB
   - B) CW
   - C) FM
   - D) AM
   - E) Other

10) How much money have you spent on amateur radio within the past year? (Include QSL expenses, magazine subscriptions, club dues, and other incidental expenditures.)
   - A) 0–$250
   - B) $251–$500
   - C) $501–$1,000
   - D) $1,001–$2,500
   - E) $2,501 and up

ELEMENT 2—SOCIAL CHARACTERISTICS

11) Has amateur radio influenced your career choice?
   - A) Greatly
   - B) Somewhat
   - C) Not at all

RESPONSE FORM

Instructions: Read each question and mark your response by circling the appropriate letter next to the number of the question. Please note that some questions have up to five possible responses, while others have as few as two. Please make only one circle next to each question number or, like the FCC, we will not count the entire question. Attach a separate sheet for any comments you might have.

Element 1:

1) A B
2) A B C D E
3) A B C D E
4) A B C D E
5) A B
6) A B C D E
7) A B C D E
8) A B C D E
9) A B C D E
10) A B C D E

Element 2:

11) A B C
12) A B
13) A B
14) A B C D E
15) A B C D E
16) A B
17) A B
18) A B
19) A B
20) A B
21) A B
22) A B
23) A B
24) A B C D E
25) A B
26) A B
27) A B C D E
28) A B

Element 3:

29) A B
30) A B C D E
31) A B
32) A B
33) A B
34) A B C D E
35) A B
36) A B C D E
37) A B C
38) A B
39) A B
40) A B
41) A B
42) A B
43) A B C
44) A B C D E
45) A B
46) A B C D E
47) A B C D E
48) A B C D E
49) A B C D E
50) A B

12) If a Novice sent you a QSL after a QSO with no return package, would you answer it?
A) Yes
B) No

13) Do you routinely look up the license class of the person you're talking to in the *Callbook*?
A) Yes
B) No

14) Do you think amateur radio was better 10 years ago?
A) Much better
B) Somewhat better
C) The same
D) Somewhat worse
E) Much worse

15) Do you think amateur radio was better 20 years ago?
A) Much better
B) Somewhat better
C) The same
D) Somewhat worse
E) Much worse

16) Did you ever use a "cheat book" to upgrade your license?
A) Yes
B) No

17) If someone offered you a million dollars, tax free, on the condition that you give up amateur radio forever, would you?
A) Yes
B) No

18) Has ham radio ever interfered in your personal relationships? (i.e., time with your wife, husband, children, lover, etc.).
A) Yes
B) No

19) Have you ever tried to interest a family member in amateur radio?
A) Yes
B) No

20) Do you think most hams have a sense of humor?
A) Yes
B) No

21) Do you get upset when you hear hams "kidding around" on the air?
A) Yes
B) No

22) Have you ever intentionally jammed a repeater or otherwise purposely interfered with a QSO?
A) Yes
B) No

23) Do you think amateur radio lowers your neighbor's opinion of you?
A) Yes
B) No

24) If your closest ham friend beat you in a major contest, how would you feel?
A) He must be a better operator than me
B) Contesting is just luck
C) The contest was set up unfairly
D) It was easy for him to win, he has better equipment
E) He must have cheated

25) Do you make most of your friends through amateur radio?
A) Yes
B) No

26) When attending a ham club meeting, flea market, or convention, do you wear a callsign badge?
A) Yes
B) No

27) If you answered yes to the above question, what size is your badge?
A) 1 line
B) 2 lines
C) 3 lines
D) 4 lines
E) Larger

28) If your closest friend won a Collins KWM-380 in a contest, would you feel jealous?
A) Yes B) No

ELEMENT 3—OPERATING HABITS

29) Do you depend on a Morse code reader or microcomputer code display for most of your CW QSOs?
A) Yes
B) No

30) What sort of CW sending devices do you use most?
A) Straight key
B) Regular keyer
C) Memory keyer
D) Keyboard
E) Never send CW

31) If required, could you solidly copy CW at the speed at which you were licensed?
A) Yes
B) No

32) Have you ever purposely operated in an amateur subband you weren't licensed to use?
A) Yes
B) No

33) Do you think the FCC affects amateur radio in a positive manner?
A) Yes
B) No

34) What do you think of the new ham exams? (Answer this even if you have never personally taken one of these new tests.)
A) Excellent
B) Good
C) Fair
D) Poor
E) Terrible

35) Just for the heck of it, have you ever talked to a friend on the "wrong" sideband? (e.g., LSB on 20 meters.)
A) Yes
B) No

36) Do you ever speak to foreign, non-English-speaking hams, in their own language?
A) Always
B) Sometimes
C) I attempt it
D) Rarely
E) Never

37) Do you think "gentlemen's agreements" have any value?
A) Always
B) Sometimes
C) Never

38) Do you feel you are competent to replace the finals in a tube-type rig?
A) Yes
B) No

39) Do you feel you are competent to replace the finals in a transistor-type rig?
A) Yes
B) No

40) Have you ever built an electronic project from a kit?
A) Yes
B) No

41) Have you ever home-brewed an electronic project from a book or magazine?
A) Yes
B) No

42) Have you ever designed your own electronic project?
A) Yes
B) No

43) After meeting a ham radio acquaintance in person for the first time, do you usually think:
A) He is better looking than you thought
B) He is worse looking than you thought
C) He is about what you expected

44) On the whole, compared to the general public, do you think:
A) Hams are much better looking
B) Hams are somewhat better looking
C) Hams are average looking
D) Hams are somewhat worse looking
E) Hams are much worse looking

45) Have you ever operated a specialized mode? (i.e., RTTY, slow scan, etc.)
A) Yes
B) No

46) What do you think of contesting?
A) Great
B) Good
C) Okay
D) Don't like it
E) Despise it

47) What do you think of DXing?
A) Great
B) Good
C) Okay
D) Don't like it
E) Despise it

48) What do you think of repeaters?
A) Great
B) Good
C) Okay
D) Don't like them
E) Despise them

49) What do you think of traffic handling?
A) Great
B) Good
C) Okay
D) Don't like it
E) Despise it

50) Do you ever secretly hope that a mild disaster will strike your community just so you could display your amateur radio skills?
A) Yes
B) No

CORRECTIONS

There are two errors in "The Sweet Sounding Probe" (July, 1980, p. 84). First, output capacitor C6 is drawn with its polarity reversed. Second, there should be a connection indicated at the four-way crossover point of pin 8 of the 555, the left-hand lead of R6, the + 12 V line from the regulator, and the line which eventually leads to pin D.

Howard Batie W7BBX
12002 Cheviot Drive
Herndon VA 22070

Readers interested in contacting the author of "Super Duper for Field Day" (November, 1980), p. 114, should use my new address and call. I have moved and there is little hope of any correspondence being forwarded.

David Hein WB8CEB
3004 Bandolino Lane
Plano TX 75075

In "Tracker—The Ultimate OSCAR Finder," January, 1981, pp. 88-95, there are some errors which have caused a bit of aggravation.

The address and telephone number of author WD8DRK, which appear near the start of the program listing on page 92, are incorrect. The correct address is given at the beginning of the article. Bruce's new phone number is (313)-835-0169. The trucking company which has been receiving his calls will appreciate your using the new number.

Lines 492 and 1830 should be deleted from the program; they are not needed.

Line 452 should be changed to read:

```
452 S$=CHR$(162)+CHR$(166)
```

The GOTO 7520 command at the end of line 1505 should be changed to GOTO 1520.

In line 1860, the left-hand bracket should actually be an up-arrow, indicating exponentiation.

Line 3190 should be changed and lines 3192 and 3194 added as follows:

```
3190 IF S=0 THEN S$="00"
3192 IF S<10 THEN S$="0"+RIGHT$(S$,1)
3194 IF S>=10 THEN S$=RIGHT$(S$,2)
```

Finally, the PET version of "Tracker" is no longer available from the authors. A version for the Apple II being planned, but it is not yet available.

Jeff DeTray WB8BTH
Assistant Publisher/Editor

It should be noted that in my article, "CB to 10—part XXIX: put that Hy-Gain CB board to use" (September, 1980, p. 102), if a 40-channel switch is used, then a jumper must be installed at the points on the board indicated by "J104."

All of my boards had it installed, although I have seen boards without them. I guess Hy-Gain had some units using different switches, or the trunk-mounted versions with interface cards that didn't require the jumper.

Many hams have written me about problems getting the trunk-mounted version running. As I cautioned in the article, you also need the mike and interface board. These parts, as described in my article, connect up to the standard circuit board in place of the channel switch (and other controls) to create the trunk-mounted version. There are, however, some nonstandard PC cards which can only be made into the fancy Hy-Gain 16 trunk-mount, microprocessor-controlled rig.

The mike on this rig looks like a calculator, with its keypad and small LED readout. The big difference is that the mike talks to the rig via a serial data line which is decoded by a special IC in the PLL chip location on the board. The main circuit board can be identified easily since it has an 18-pin MM58141N IC in place of the usual 16-pin PLL chip. Because of the serial data connection, the PLL cannot be converted as described in my article unless someone is willing to do a lot of digital design work with the microphone—definitely not worth the effort on a $10 circuit board.

I have talked to the people at Meshna, and they are willing to ship the convertible standard board (current price $8 for the board or $10 for the trunk-mount chassis) to anyone specifying that it is for conversion as in my article. This is a bit of extra work for them as they have to sort through the pile to find a standard unit. People should address requests to John Meshna, *Jr.*, PO Box 62, E. Lynn MA 01904.

Penn Clower W1BG
459 Lowell Street
Andover MA 01810

HAM HELP

I have an Edgecom 3000A 2m transceiver with several problems but no parts placement diagram or schematic-to-component (manufacturers' designation) table. Does anyone have same, or know where I can get this unit repaired? I understand that the original manufacturer is no longer in operation.

Tom Pendarvis WD0EMP
215 Wildbrier
Ballwin MO 63011

I recently acquired a National NC-173 general coverage shortwave receiver. I am in need of a manual and schematic. I will gladly pay any duplication cost and mailing costs.

Gary Stone
WLS-INC
2 Halifax Road
Havelock NC 28532

I need schematic and service info for GE-TPL model FE73JA6 FM 2-way radio. I will pay postage if I can borrow to make a copy. Thanks.

Tom McLaughlin WB4NEX
13308-D Orange Tree Ln.
Tampa FL 33618

I need a schematic diagram and availability information on a Johnson or B&W electronic T-R switch.

Robert F. Cann W4GBB
1606 Lochwood Dr.
Richmond VA 23233

I need a serviceable 833A tube; please advise condition and my cost including transportation.

Edward Dobbelaere W7LEI
4164 Long Lake Road, SE
Port Orchard WA 98366

NEW PRODUCTS

from page 36

available, over-the-counter, from electronic and personal computer component stores throughout the United States and Canada. Highlighted are microcomputer interface boards, Vector Plugbords™, motherboards, cases, tools, wiring terminals, and kits. A complete price list is included. *Vector Electronic Company, Inc., 12460 Gladstone Avenue, Sylmar CA 91342; (213)-365-9661.* Reader Service number 478.

FIVE-MODE KEYBOARD

A five-mode sending terminal introduced by Curtis Electro Devices offers keyboard origination of Morse, ASCII, and Baudot codes in addition to being a paddle keyer, code practice generator, and contest memory unit. Called the KB-4900, this unit blends the power of a microprocessor with the ease of analog controls and indicators.

Features include a 256-key sending buffer and a 256-key soft-sectored message memory with up to four callups. The two-key lockout and fully debounced keyboard offers all domestic, European, and many commercial prosigns for CW, all Baudot characters, and upper- and lowercase ASCII communication characters. Automatic line length control, word wrap-around, hold, and backspace are included. All LTRS and FIGS shifts are automatic in the Baudot mode.

Analog controls (pots) are provided for speed, weight, pitch, and volume, and meters display Morse speed and buffer status. Output is via mercury relays for the keyline and PTT (or KOS) line. RTTY output is a loop switch.

The message memories include three fixed preambles (CQ, CQ TEST, ID and QRZ) plus up to four programmable memories. An automatic serial number can be inserted in any memory or the buffer for contests. An optional real-time clock inserts 24-hour time in the buffer of memory.

The code-practice mode generates either true random (no answers) or pseudo-random five-letter Morse groups in eight lists (with answers). Character spacing can be expanded for easier learning. Powered by either ac or +12 V dc, the KB-4900 measures 12" × ½" × 4½" and weighs 5 lbs.

For detailed specifications, write *Curtis Electro Devices, Inc., Box 4090, Mountain View CA 94040; (415)-494-7223.* Reader Service number 476.

HYBRID IC USES TOUCH-TONE® PHONE FOR DATA INPUT

The Teltone M-927 accepts all 16 dual-tone multi-frequency (DTMF or touch-tone) digits, plus rotary dial pulses, from a telephone, radio, or other source. Logic output drives transistor, low-power Schottky TTL, MOS, or CMOS devices. When coupled with a CMOS driver, the M-927 can operate a digital display.

DTMF signals can be transmitted anywhere in the world over the switched telephone network because DTMF digit frequencies fall in the voice band. Access to data entry and control devices is literally universal. The Teltone M-927 is an easy and reliable way to interface telephones to data processing, control, and monitoring equipment, and to consumer-oriented financial service systems. Pin-selectable logic outputs include: binary, 2 of 8 (2 of 7), 1 of 12, or blank. Strobe, three convenient clock frequencies, signal presence, and DTMF/dial pulse mode indications are provided.

The 40-pin DIP hybrid contains a proprietary Teltone LSI device, dial-tone filters, band-split filters, and clock circuits. It requires only a 3.579-MHz color burst crystal and a single 12 V dc source to become a complete decoder circuit. *Teltone Corporation, 10801-120th Avenue N.E., Kirkland WA 98033; (206)-827-9626.* Reader Service number 477.

HIGH PERFORMANCE TOWER GUYS

Philadelphia Resins Corporation announces a new line of PHILLYSTRAN® high performance tower guys which shows significant improvement in performance over previous offerings, particularly in the area of low stretch.

PHILLYSTRAN® has been used successfully by over 400 commercial broadcast stations since its introduction in 1973. In these applications, PHILLYSTRAN® was chosen over competitive materials such as wire strand and GRP rod primarily because of its combination of light weight, high strength, good dielectric properties, and ease of installation. Recently a survey conducted among tower manufacturers, riggers, and station engineers showed that minimizing tower deflection is the most important concern in selecting guys. With this in mind, Philadelphia Resins Corporation initiated a program to improve the performance of its tower guys. The result is an entirely new family of cables called PHILLYSTRAN® HPTG which is specifically designed to be used for supporting large towers.

The major improvement found in PHILLYSTRAN® HPTG is its much lower elongation, not exceeding 0.3% at usual working loads and less than 1% at tensile loads up to 50% of the minimum break strength. This low elongation together with negligible creep will decrease tower deflection and also makes possible a simple tensioning procedure when installing the guys. In addition to favorable stretch characteristics, PHILLYSTRAN® HPTG shows enhancement in other areas. Diameter for diameter, it is stronger than extra-high-strength galvanized steel strand and also enjoys a three- to fourfold advantage in weight per foot.

For further information, contact *Philadelphia Resins Corporation, 20 Commerce Drive, Montgomeryville PA 18936; (215)-855-8450.* Reader Service number 481.

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COAX-SEAL is a pliable, plastic material which is wound over coax fittings of any size or shape and then hand-molded to provide a long-lasting, flexible, waterproof and dustproof seal. This new material stays flexible at temperatures from −25° F to 350° F.

COAX-SEAL maintains its sealing qualities regardless of movement of the coax and adheres to polyvinyl or vinyl coax jackets. The material allows the quick decoupling of a coax fitting and also the resealing of the fitting using the same material. Application is by hand—roll off approximately 6" of COAX-SEAL, remove backing paper, wrap starting at outer covering, and work towards fitting, allowing a one-half overlap as you go. After the wrap is completed, gently knead to form a smooth surface and to force out any air.

COAX-SEAL comes in rolls 60" long, 1/8" thick, and 1/2" wide. 50-foot industrial rolls also are available. *Universal Electronics, Inc., 1280 Aida Drive, Reynoldsburg OH 43068; (614)-866-4605.* Reader Service number 479.

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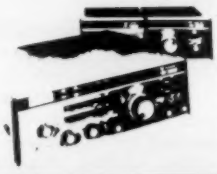

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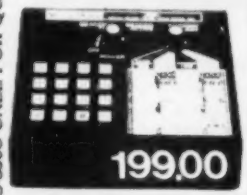

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7442N	65	LM340K-8	1.35	CD4049	65
7447N	63	LM340K-12	1.35	CD4050	69
7448N	77	LM340K-15	1.35	CD4051	1.13
7473N	35	LM340K-24	1.35	CD4066	1.42
7474N	35	LM340T-5	1.25	CD4068	71
7475N	49	LM340T-8	1.25	CD4069	40
7480N	88	LM340T-12	1.25	CD4069	40
7486N	1.70	LM340T-15	1.25	CD4070	50
7490N	43	LM340T-18	1.25	CD4071	50
7492N	43	LM340T-24	1.25	CD4072	45
7493N	43	LM341P	5.50	CD4073	45
7495N	69	LM377	2.95	CD4075	45
74100N	1.35	LM379	5.00	CD4076	1.45
74107N	35	LM380N	1.00	CD4078	40
74121N	34	LM381	1.60	CD4081	35
74123N	59	LM382	1.60	CD4082	35
74125N	45	LM709N	59	CD4116	47
74145N	77	LM723H/N	50	CD4490	5.50
74150N	1.20	LM733N	85	CD4507	1.00
74151N	69	LM741CH	35	CD4508	2.85
74154N	1.25	LM741N	38	CD4510	1.00
74157N	69	LM747H/N	75	CD4511	94
74161N	87	LM748N	50	CD4515	2.52
74162N	85	LM1303N	1.75	CD4516	1.10
74163N	87	LM1304	1.19	CD4518	1.50
74174N	96	LM1305	1.27	CD4520	1.07
74175N	85	LM1307	2.00	CD4527	1.51
74189N	1.15	LM1310	1.95	CD4528	1.69
74192N	87	LM1458	55	CD4553	3.50
74193N	85	LM1812	7.50	CD4566	2.45
74221N	1.25	LM1889	3.00	CD4583	2.35
74298N	1.65	LM2111	1.75	CD4585	1.10
74365N	75	LM2901	2.25	CD40192	3.60
74367N	75	LM3900N	55	CD40193	3.60
74367N	75	LM3905	1.75	MC4044	40
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74LS00 TTL		MC1458V	55	MC4114	89
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74LS08N	35	NE568N	1.58	MC4175	1.25
74LS10N	35	NE5570	1.50	MC4194	1.95
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74LS14N	1.00	78L05	60	MC4232	3.50
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74LS86N	69	**A to D CONVERTER**		MC4023	5.58
74LS93N	75	8038	4.50	MC3925	7.50
74LS96N	1.69	8700	13.95	CDP1802CD	28.85
74LS107N	45	8701CN	22.60	CDP1802D	26.09
74LS112N	45	8708CJ	13.95	CDP1802E	17.98
74LS113N	45	LD130	9.95		
74LS132N	89	9400CJ/N/F	7.48	**INTERFACE**	
74LS151N	75	ICL7107	14.25	8080	65
74LS151N	99	ICL7107	14.25	8097	65
74LS155N	1.10			8212	65
74LS157N	1.10	**CMOS**		8709	1.25
74LS162N	1.10	CD4000	25	8T01	4.50
74LS163N	1.10	CD4001	30	8T12	3.60
74LS174N	1.25	CD4002	35	8T20	3.50
74LS189N	2.25	CD4006	1.10	8T23	3.50
74LS221N	1.25	CD4007	35	8T24	3.50
74LS259N	1.89	CD4008	1.75	8T26	3.50
74LS367N	75	CD4009	45	8T28	3.50
		CD4010	45	8T31	2.75
LINEAR		CD4011	30	8T97	2.75
CA3045	99	CD4012	30	8T98	1.69
CA3046	1.19	CD4013	60		
CA3081	1.80	CD4014	1.25		
CA3082	1.80	CD4015	1.00	**MISCELLANEOUS RAM**	
CA3083	1.40	CD4016	60	2101-1	2.95
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LM308H	87	CD4018	1.45	2102N-4	1.45
LM307N	35	CD4019	40	2102N4-2L	1.60
LM308N	1.59	CD4020	1.05	2114A-4	4.95
LM309K	1.25	CD4021	1.05	2114L-4	5.95
LM311H/N	99	CD4022	1.19	2115-1	3.75
LM317T	1.65	CD4023	30	2115-2	3.95
LM317K	3.75	CD4024	75	2114	3.75
LM318	1.50	CD4025	28	2114L 300ns	4.25

CONNECTORS

30 pin edge	2.50
44 pin edge	2.75
86 pin edge	4.00
100 pin edge	4.50
100 pin edge WW	5.25

IC SOCKETS

Solder Tin Low Profile

PIN	14P	PIN	16P
8	.15	16	.16
14	.24	24	.35
16	.26	28	.42
18	.29	40	.57

2 level 14 pin ww .20

WIRE WRAP LEVEL 3

PIN	PIN
14	32 .86
16	33 .28 1.00
18	40 1.23

CLOCKS

MM5311	5.50
MM5312	3.90
MM5314	3.90
MM5369	2.10
MM5841	14.45
MM5865	7.95
CCT7010	6.95
MM5375AA/N	3.90
MM5375AG/N	4.90
32768 Hz	4.00
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3.2768 MHz	4.50
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1.185 MHz	4.50
18.432 MHz	4.50
22.1184 MHz	4.50

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AY5-2376	$12.50
AY5-3600	17.95
AY5-8189	10.88
AY5-9200	16.50
74C923	5.50
74C922	5.99
HD0165	6.95
AY5-9400	10.50

D Connectors RS232

DB25P	3.82
DB25S	5.75
Cover	1.67
DA15P	2.10
DA15S	3.10
Insertion Set	9.00

Hitachi 3½ Digit LED multimeter $9.95
Dispatch Kit 39.95
Optn Case Kit 17.98
Digital Clock Kit 14.95

DK-10E Epram Kit
(less PROMS) $80.00
Motherboard $39.00
Extender Board $15.00

RESISTORS ¼ watt 5%
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100 per type .015
500 per type .012
350 piece pack
5 per type 6.75

½ watt 5% per type .05

Televideo Terminal
Model 912 $845.00
Model 950 $945.00

Tiny Basic Experimenters Kit $10.00

BBR Controller $39.95
Connect your computer to the BSR Home Control System. Computer controlled ultrasonic trans-mitter for your BSR Software for 1802 user.

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56 key ASCII keyboard kit	$67.50
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53 key ASCII keyboard kit	60.00
Fully assembled	70.00
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LEDS

Red T01¾	15
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Green, Orange, Yellow Jumbo	25
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(specify red, amber, green, yellow clear)	

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30 MHz Frequency Counter Kit	**$47.75**

TRANSFORMERS

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12 Volt 300 ma transformer	1.25
12 6V CT 600 ma	3.75
12V 250 ma wall plug	2.95
12v CT 250 ma wall plug	3.75
24V CT 100 ma	3.95
10V 1 2 amp wall plug	4.88
12V 6 amp	12.95
12V 300 ma wall plug	4.75
12V 1 amp wall plug	6.50
10/15 VAC 8/15 VA wall plug	9.75

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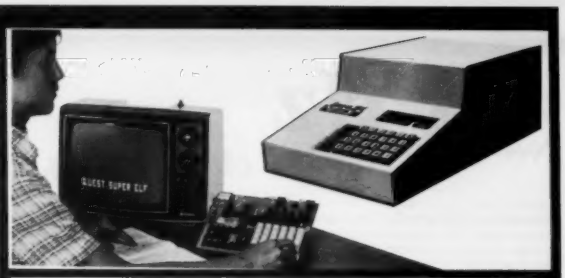
MAN1	CA	270	2.98
MAN3	CC	125	.39
MAN72/74	CA/CA	300	1.00
DL704	CC	300	1.25
DL707-DL707R	CA	300	1.00
DL727-728	CA/CC	560	1.98
DL747-750	CA/CC	560	1.95
FND359	CC	357	.79
FND500/507	CC/CA	500	1.35
FND503-510	CC/CA	500	.90
FND800-807	CC/CA	800	2.20
3 digit Bubble			.60
10 digit display			1.25
7520 Clares photocells			.39
TIL311 Hex			9.50
MAN3640	CC	30	1.10
MAN4610	CA	40	1.20
MAN4640	CC	40	1.20
MAN4710	CA	40	.95
MAN4740	CC	40	1.20
MAN6640	CC	56	2.95
MAN6710	CA	60	1.35
MAN6740	CC	60	1.35

MA1000A, C, E	**6.95**
MA1012A	**8.95**
1002P3 transformer	**2.25**
MA1012A Transformer	**2.25**



RCA Cosmac 1802 Super Elf Computer $106.95

Compare features before you decide to buy any other computer. There is no other computer on the market today that has all the desirable benefits of the **Super Elf** for so little money. The Super Elf is a small single board computer that does many **big** things. It is an excellent computer for training and for learning programming with its machine language and yet it is easily **expanded** with **additional memory, Full Basic, ASCII Keyboards, video character generation, etc.**

Before you buy another small computer, see if it includes the following features: ROM monitor; State and Mode displays; Single step; Optional address displays; Power Supply; Audio Amplifier and Speaker; Fully socketed for all IC's; Real cost of in warranty repairs; Full documentation.

The **Super Elf** includes a **ROM** monitor for program loading, editing and execution with **SINGLE STEP for program debugging** which is not included in others at the same price. With **SINGLE STEP** you can see the microprocessor chip operating with the **unique Quest** address and data bus displays **before, during** and **after** executing instructions. Also, CPU mode and instruction cycle are decoded and displayed on 8 LED indicators.

An RCA 1861 **video graphics** chip allows you to connect to your own TV with an inexpensive video modulator to do graphics and games. There is a **speaker system** included for writing your own music or using many music programs already written. The speaker amplifier may also be used to drive relays for control purposes.

A 24 key **HEX keyboard** includes 16 HEX keys plus **load, reset, run, wait, input, memory protect, monitor select** and **single step**. Large, on board displays provide output and optional **high and low address**. There is a 44 pin standard connector slot for PC cards and a power supply connector slot for the Quest Super Expansion Board. Power supply and sockets for **all** IC's are included in the price plus a detailed 127 pg. instruction manual which now includes over 40 pgs. of software info. including a series of lessons to help get you started and a music program and graphics target game. Many schools and universities are using the Super Elf as a course of study. OEM's use it for training and R&D.

Remember, other computers only offer Super Elf features at additional cost or not at all. **Compare before you buy. Super Elf Kit $106.95, High address option $8.95, Low address option $9.95. Custom Cabinet** with drilled and labelled plexiglass front panel **$24.95.** All metal Expansion Cabinet, painted and silk screened, with room for 5 S-100 boards and power supply **$57.00. NiCad Battery Memory Saver Kit $6.95.** All kits and options also completely assembled and tested.

Questdata, a software publication for 1802 computer users is available by subscription for $12.00 per 12 issues. Single issues $1.50. Issues 1-12 bound $16.50.

Tiny Basic Cassette **$10.00,** on ROM **$38.00,** original Elf kit board **$14.95. 1802 software;** Moews Video Graphics **$3.50.** Games and Music **$3.00,** Chip 8 Interpreter **$5.50.**

Super Expansion Board with Cassette Interface $89.95

This is truly an astounding value! This board has been designed to allow **you** to decide how you want it optioned. **The Super Expansion Board comes with 4K of low power RAM** fully addressable anywhere in 64K with built-in memory protect and a **cassette interface**. Provisions have been made for all other options on the same board and it fits neatly into the hardwood cabinet alongside the **Super Elf.** The board includes slots for up to 6K of **EPROM** (2708, 2758, 2716 or TI 2716) and is **fully socketed.** EPROM can be used for the monitor and Tiny Basic or other purposes.

A 1K Super ROM Monitor $19.95 is available as an on board option in 2708 EPROM which has been preprogrammed with a program loader/editor and error checking multi file cassette read/write software, (relocatable cassette file) another exclusive from Quest. It includes register save and readout, block move capability and video graphics driver with blinking cursor. Break points can be used with the register save feature to isolate program bugs quickly, then follow with single step. If you have the **Super Expantion Board** and **Super Monitor** the monitor is up and running at the push of a button.

Other on board options include **Parallel Input and Output Ports** with **full handshake.** They allow easy connection of an ASCII keyboard to the input port. **RS 232 and 20 ma Current Loop** for teletype or other device are on board and if you need more memory there are two **S-100** slots for static RAM or video boards. Also a 1K Super Monitor version 2 with video driver for full capability display with Tiny Basic and a video interface board. **Parallel I/O Ports $9.85, RS 232 $4.50, TTY 20 ma I/F $1.95, S-100 $4.50. A 50 pin connector set** with ribbon cable is available at $15.25 for easy connection between the **Super Elf** and the **Super Expansion Board.**

Power Supply Kit for the complete system (see Multi-volt Power Supply).

Quest Super Basic V5.0

A new enhanced version of **Super Basic** now available. Quest was the first company worldwide to ship a full size Basic for 1802 Systems. A complete function **Super Basic** by **Ron Cenker** including floating point capability with scientific notation (number range $\pm .17E^{\pm 38}$), 32 bit integer ± 2 billion; multi dim arrays, string arrays; string manipulation; cassette I/O; save and load, basic, data and machine language programs; and over 75 statements, functions and operations.

New improved faster version including **renumber** and essentially **unlimited variables.** Also, an exclusive user expandable command library.

Serial and Parallel I/O included.

Super Basic on Cassette $55.00.

PROM Eraser

assembled. 25 PROM capacity **$37.50** (with timer **$69.50**). 6 PROM capacity OSHA/UL version **$89.50** (with timer **$94.50**).

Z80 Microcomputer

16 bit I/O, 2 MHz clock, 2K RAM, ROM Breadboard space. Excellent for control. Bare Board **$28.50.** Full Kit **$99.00.** Monitor **$20.00.** Power Supply Kit **$35.00. Tiny Basic $30.00**

S-100 Computer Boards

8K Static Godbout Econo IIA Kit	149.00
16K Static Godbout Econo XIV Kit	269.00
24K Static Godbout Econo XX-24 Kit	414.00
32K Static Godbout Econo XX-32 Kit	537.00
16K Dynamic RAM Kit	289.00
32K Dynamic RAM Kit	328.00
64K Dynamic RAM Kit	399.00
Video Interface Kit	**$139.00**

80 IC Update Master Manual $39.00

Comp. IC data selector, 2700 pg. master reference guide. Over 51,000 cross references. Free update service through 1980. Domestic postage $3.50.

Modem Kit $60.00

State of the art, orig., answer. No tuning necessary. 103 compatible 300 baud. Inexpensive acoustic coupler plans included. Bd. only $17.00.

LRC 7000 + Printer $389.00

40/20 column dot matrix impact, std. paper. Interface all personal computers.

64/40/32/20 version **$465.00.** Optional cables available.

LRC 7000 printer interface cable for Super Elf with software $26.00

NiCad Battery Fixer/Charger Kit

Opens shorted cells that won't hold a charge and then charges them up, all in one kit w/full parts and instructions. **$7.25**

Rockwell AIM 65 Computer

6502 based single board with full ASCII keyboard and 20 column thermal printer. 20 char. alphanumeric display, ROM monitor, fully expandable. **$375.00.** 4K version **$450.00.** 4K Assembler **$85.00.** 8K Basic Interpreter **$100.00.**

Special small power supply for AIM65 assem. in frame **$54.00.** Complete AIM65 in thin briefcase with power supply **$499.00.** Molded plastic enclosure to fit both AIM65 and power supply **$47.50.** Special Package Price: 4K AIM, 8K Basic, power supply, cabinet **$599.00**

AIM65/KIM/VIM/Super Elf 44 pin expansion board; 3 female and 1 male bus. Board plus 3 connectors **$22.95.**

60 Hz Crystal Time Base Kit $4.40

Converts digital clocks from AC line frequency to crystal time base. Outstanding accuracy.

Video Modulator Kit $9.95

Convert TV set into a high quality monitor w/o affecting usage. Comp. kit w/full instruc.

Multi-volt Computer Power Supply

8v 5 amp, ±18v .5 amp, 5v 1.5 amp, −5v .5 amp, 12v .5 amp, −12v option. ±5v, ±12v are regulated. Basic Kit **$29.95.** Kit with chassis and all hardware **$43.95.** Add $4.00 shipping. Kit of hardware **$14.00.** Woodgrain case **$10.00.** $1.50 shipping.

Gremlin Color Video Kit $69.95

32 x 16 alpha/numerics and graphics; up to 8 colors with 6847 chip; 1K RAM at E000. Plugs into Super Elf 44 pin bus. No high res. graphics. On board RF Modulator Kit **$4.95**

Elf II Adapter Kit $24.95

Plugs into Elf II providing Super Elf 44 and 50 pin plus S-100 bus expansion. (With Super Expansion). High and low address displays, state and mode LED's optional **$18.00.**

1802 16K Dynamic RAM Kit $149.00

Expandable to 32K. Hidden refresh w/clocks up to 4 MHz w/no wait states. Addl. 16K RAM **$63.00**

Super Elf 44 pin expansion board; 3 female and 1 male bus. Board plus 3 connectors **$22.95**

Tiny Basic Extended on Cassette (added commands include Stringy, Array, Cassette I/O etc.)	**$15.00**
S-100 4-Slot Expansion	**$ 9.95**
Super Monitor V1.1 Source Listing	**$15.00**

Super Color S-100 Video Kit $129.95

Expandable to 256 x 192 high resolution color graphics. 6847 with all display modes computer controlled. Memory mapped. 1K RAM expandable to 6K. S-100 bus 1802, 8080, 8085, Z80 etc.

Editor Assembler	**$25.00**
(Requires minimum of 4K for E/A plus user source)	
1802 Tiny Basic Source listing	**$19.00**
Super Monitor V2.0/2.1 Source Listing	**$20.00**

TERMS: $5.00 min. order U.S. Funds. Calif residents add 6% tax. $10.00 min. BankAmericard and Master Charge accepted. $1.00 insurance optional. Postage: Add 5%. C.O.D. $10.00 min. order.

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1900 MHz to 2500 MHz DOWN CONVERTER
This receiver is tunable a range of 1900 to 2500 mc and is intended for amateur radio use. The local oscillator is voltage controlled (i.e) making the i-f range approximately 54 to 88 mc (Channels 2 to 7).

PC BOARD WITH DATA $19.99
PC BOARD WITH CHIP CAPACITORS 13 ..... $44.99
PC BOARD WITH ALL PARTS FOR ASSEMBLY $69.99
PC BOARD WITH ALL PARTS FOR ASSEMBLY PLUS 2N6603 ..... $89.00
PC BOARD ASSEMBLED AND TESTED $99.99
PC BOARD WITH ALL PARTS FOR ASSEMBLY, POWER SUPPLY AND ANTENNA $159.99
POWER SUPPLY ASSEMBLED AND TESTED $49.99
YAGI ANTENNA 4' LONG APPROX. 20 TO 23 dB GAIN $49.99
YAGI ANTENNA 4' WITH TYPE (N, BNC, SMA Connector) $64.99
2 FOOT DISH WITH FEED AND MOUNT $59.99
2300 MHz DOWN CONVERTER
Includes converter mounted in antenna, power supply, Plus 90 DAY WARRANTY $259.99
OPTION #1 MRF902 in front end. (7 dB noise figure) $299.99
OPTION #2 2N6603 in front end. (5 dB noise figure) $359.99
2300 MHz DOWN CONVERTER ONLY
10 dB Noise Figure 23 dB gain in box with N conn. Input F conn. Output $149.99
7 dB Noise Figure 23 dB gain in box with N conn. Input F conn. Output $169.99
5 dB Noise Figure 23 dB gain in box with SMA conn. Input F conn. Output $189.99
DATA IS INCLUDED WITH KITS OR MAY BE PURCHASED SEPARATELY $15.00

Shipping and Handling Cost:
Receiver Kits and $1.50. Power Supply add $2.00. Antenna add $5.00. Option 1/2 add $3.00. For complete system add $7.50.

HOWARD/COLEMAN TVRO CIRCUIT BOARDS

DUAL CONVERSION BOARD $25.00
This board provides conversion from the 3.7-4.2 band first to 900 MHz where gain and bandpass filtering are provided and, second, to 70 MHz. The board contains both local oscillators, one fixed and the other variable, and the second mixer. Construction is greatly simplified by the use of Hybrid IC amplifiers for the gain stages. Bare boards cost $25 and it is estimated that parts for construction will cost $270. (Note: The two Avantek VTO's account for $225 of this cost.)

47 pF CHIP CAPACITORS $6.00
For use with dual conversion board. Consists of 6-47 pF.

70 MHz IF BOARD $25.00
This circuit provides about 43 dB gain with 50 ohm input and output impedance. It is designed to drive the HOWARD/COLEMAN TVRO Demodulator. The on-board band pass filter can be tuned for bandwidths between 20 and 35 MHz with a passband ripple of less than ½ dB. Hybrid ICs are used for the gain stages. Bare boards cost $25. It is estimated that parts for construction will cost less than $40.

.01 pF CHIP CAPACITORS $7.00
For use with 70 MHz IF Board. Consists of 7-.01 pF.

DEMODULATOR BOARD $40.00
This circuit takes the 70 MHz center frequency satellite TV signals in the 10 to 200 millivolt range, detects them using a phase locked loop, deemphasizes and filters the result and amplifies the result to produce standard NTSC video. Other outputs include the audio subcarrier, a DC voltage proportional to the strength of the 70 MHz signal, and AFC voltage centered at about 2 volts DC. The bare board cost $40 and total parts cost less than $30.

SINGLE AUDIO $15.00
This circuit recovers the audio signals from the 6.8 MHz frequency. The Miller 9051 coils are tuned to pass the 6.8 MHz subcarrier and the Miller 9052 coil tunes for recovery of the audio.

DUAL AUDIO $25.00
Duplicate of the single audio but also covers the 6.2 range.

DC CONTROL $15.00
This circuit controls the VTO's, AFC and the S Meter.

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11C90DC	650 MHz Prescaler Divide by 10/11	16.50
11C91DC	650 MHz Prescaler Divide by 5/6	16.50
11C83DC	1 GHz Divide by 248/256 Prescaler	29.90
11C70DC	600 MHz Flip/Flop with reset	12.30
11C58DC	ECL VCM	4.53
11C44DC/MC4044	Phase Frequency Detector	3.82
11C24DC/MC4024	Dual TTL VCM	3.82
11C06DC	UHF Prescaler 750 MHz D Type Flip/Flop	12.30
11C05DC	1 GHz Counter Divide by 4	50.00
11C01FC	High Speed Dual 5-4 input NO/NOR Gate	15.40

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Frequency response 40 MHz to 300 MHz
Gain: 300 MHz 16 dB Min., 17.5 dB Max.
50 MHz 0 to – 1 dB from 300 MHz
Voltage: 24 volts dc at 220 ma max. $19.99

CARBIDE — CIRCUIT BOARD DRILL BITS FOR PC BOARDS

Size: 35, 42, 47, 49, 51, 52	$2.15
Size: 53, 54, 55, 56, 57, 58, 59, 61, 63, 64, 65	1.85
Size: 66	1.90
Size: 1.25 mm, 1.45 mm	2.00
Size: 3.20 mm	3.58

CRYSTAL FILTERS: TYCO 001-19880 same as 2194F

10.7 MHz Narrow Band Crystal Filter
3 dB bandwidth 15 kHz min. 20 dB bandwidth 60 kHz min. 40 dB bandwidth 150 kHz min.
Ultimate 50 dB: Insertion loss 1.0 dB max. Ripple 1.0 dB max. Ct. 0 + / – 5 pf 3600 ohms. $5.95

MURATA CERAMIC FILTERS

Models:	SFD-455D 455 kHz	$3.00
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	CFM-455E 455 kHz	7.95
	SFE-10.7 10.7 MHz	5.95

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Hewlett Packard:

491C	TWT Amplifier 2 to 4 Gc 1 watt 30 dB gain	$1150.00
608C	10 mc to 480 mc .1 uV to.5V into 50 ohms Signal Generator	500.00
608D	10 to 420 mc .1 uV to.5V into 50 ohms Signal Generator	500.00
612A	450 to 1230 mc .1 uV to .5V into 50 ohms Signal Generator	750.00
614A	900 to 2100 mc. Signal Generator	500.00
616A	1.8 to 4.2 Gc Signal Generator	400.00
616B	1.8 to 4.2 Gc Signal Generator	500.00
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618B	3.8 to 7.2 Gc Signal Generator	500.00
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2N1692	15.00	2N5637	22.15	MM1553	56.50
2N1693	15.00	2N5641	6.00	MM1601	5.50
2N2632	45.00	2N5642	10.05	MM1602/2N5842	7.50
2N2857JAN	2.52	2N5643	15.82	MM1607	8.85
2N2876	12.35	2N6545	12.38	MM1661	15.00
2N2880	25.00	2N5764	27.00	MM1669	17.50
2N2927	7.00	2N5842	8.78	MM1943	3.00
2N2947	18.35	2N5849	21.29	MM2605	3.00
2N2948	15.50	2N5862	51.91	MM2608	5.00
2N2949	3.90	2N5913	3.25	MM8008	2.23
2N2950	5.00	2N5922	10.00	MMCM918	20.00
2N3287	4.30	2N5942	46.00	MMT72	1.17
2N3294	1.15	2N5944	8.92	MMT74	1.17
2N3301	1.04	2N5945	12.38	MMT2857	2.63
2N3302	1.05	2N5946	14.69	MRF245	33.30
2N3304	1.48	2N6080	7.74	MRF247	33.30
2N3307	12.60	2N6081	10.05	MRF304	43.45
2N3309	3.90	2N6082	11.30	MRF420	20.00
2N3375	9.32	2N6083	13.23	MRF450	11.85
2N3553	1.57	2N6084	14.66	MRF450A	11.85
2N3755	7.20	2N6094	7.15	MRF454	21.83
2N3818	6.00	2N6095	11.77	MRF458	20.68
2N3866	1.09	2N6096	20.77		
2N3866JAN	2.80	2N6097	29.54		
2N3866JANTX	4.49	2N6136	20.15	MRF502	1.08
2N3924	3.34	2N6166	38.60	MRF504	6.95
2N3927	12.10			MRF509	4.90
2N3950	26.86			MRF511	8.15
2N4072	1.80	2N6439	45.77	MRF901	5.00
2N4135	2.00	2N6459/PT9795	18.00	MRF5177	21.82
2N4261	14.60	2N6603	12.00	MRF8004	1.60
2N4427	1.20	2N6604	12.00	PT4186B	3.00
2N4957	3.62	A50-12	25.00	PT4571A	1.50
2N4958	2.92	BFR90	5.00	PT4612	5.00
2N4959	2.23	BLY568C	25.00	PT4628	5.00
2N4976	19.00	BLY568CF	25.00	PT4640	5.00
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2N5108	4.03	HEP78/S3014	4.95	PT9784	24.30
2N5109	1.66	HEPS3002	11.30	PT9790	41.70
2N5160	3.49	HEPS3003	29.88	SD1043	5.00
2N5179	1.05	HEPS3005	9.95	SD1116	3.00
2N5184	2.00	HEPS3006	19.90	SD1118	5.00
2N5216	47.50	HEPS3007	24.95	SD1119	3.00
2N5583	4.55	HEPS3010	11.34		
2N5589	6.82	HEPS5026	2.56		
		HP35831E/		TRWMRA2023-1.5	42.50
		HXTR5104	50.00	40281	10.90
		MM1500	32.20	40282	11.90
				40290	2.48

CHIP CAPACITORS

1pf	27pf	220pf	1200pf
1.5pf	33pf	240pf	1500pf
2.2pf	39pf	270pf	1800pf
2.7pf	47pf	300pf	2200pf
3.3pf	56pf	330pf	2700pf
3.9pf	68pf	360pf	3300pf
4.7pf	82pf	390pf	3900pf
5.6pf	100pf	430pf	4700pf
6.8pf	110pf	470pf	5600pf
8.2pf	120pf	510pf	6800pf
10pf	130pf	560pf	8200pf
12pf	150pf	620pf	.010mf
15pf	160pf	680pf	.012mf
18pf	180pf	820pf	.015mf
22pf	200pf	1000pf	.018mf

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1,001 up	.49

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  Minimum Gain = 12 dB
  Efficiency = 50%

MRF458 $20.68

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. . . designed for power amplifier applications in industrial, commerical and amateur radio equipment to 30 MHz.

- Specified 12.5 Volt, 30 MHz Characteristics –
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  Minimum Gain = 12 dB
  Efficiency = 50%
- Capable of Withstanding 30:1 Load VSWR @ Rated P_{out} and V_{CC}

MRF472 $2.50

NPN SILICON RF POWER TRANSISTOR

. . . designed primarily for use in large-signal output amplifier stages. Intended for use in Citizen-Band communications equipment operating at 27 MHz. High breakdown voltages allow a high percentage of up-modulation in AM circuits.

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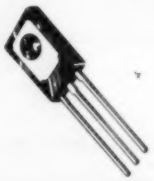
  Power Gain = 10 dB Minimum
  Efficiency = 65% Typical



MRF475 $5.00

NPN SILICON RF POWER TRANSISTOR

. . . designed primarily for use in single sideband linear amplifier output applications in citizens band and other communications equipment operating to 30 MHz.

- Characterized for Single Sideband and Large-Signal Amplifier Applications Utilizing Low-Level Modulation.
- Specified 13.6 V, 30 MHz Characteristics –
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  Minimum Efficiency = 40% (SSB)
  Output Power = 4.0 W (CW)
  Minimum Efficiency = 50% (CW)
  Minimum Power Gain = 10 dB (PEP & CW)
- Common Collector Characterization

MHW710 - 2 $46.45 440 to 470MC

UHF POWER AMPLIFIER MODULE

. . . designed for 12.5 volt UHF power amplifier applications in industrial and commercial FM equipment operating from 400 to 512 MHz.

- Specified 12.5 Volt, UHF Characteristics –
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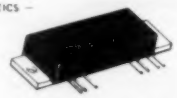
  Harmonics = 40 dB



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561	DC to 10MHZ Scope Rack Mount	150.00
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565	DC to 10MHZ Dual Beam Scope with a 2A63 Diff and a 2A61 Diff. Plug In's	900.00
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4CX250R	92.00	6146	5.00	8458	25.75
4CX300A	147.00	6146A	6.00	8560A/AS	50.00
4CX350A	107.00	6146B/8298A	7.00	8908	9.00
				8950	9.00

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3614-60	Variable Attenuator 0 to 60dB	75.00
KU520A	Variable Attenuator 18 to 26.5 GHz	100.00
4684-20C	Variable Attenuator 0 to 180dB	100.00
6684-20F	Variable Attenuator 0 to 180dB	100.00

General Microwave

Directional Coupler 2 to 4GHz 20dB Type N	75.00

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X487B	100 ohms Neg. Thermistor Mount (USED)	125.00
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478A	200 ohms Neg. Thermistor Mount (USED)	150.00
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394A	1 to 2 GHz Variable Attenuator 6 to 120dB	250.00
NK292A	Waveguide Adapter	65.00
K422A	18 to 26.5 GHz Crystal Detector	250.00
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8439A	2 GHz Notch Filter	75.00
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G532A	3.95 to 5.85 GHz Frequency Meter	300.00
J532A	5.85 to 8.2 GHz Frequency Meter	300.00
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X638S	Horn 8.2 - 12.4 GHz	60.00
601-818	X to N Adapter 8.2 - 12.4 GHz	35.00
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4013C-10/	22540A Directional Coupler 2 to 4 GHz 10db Type SMA	90.00
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22574	Directional Coupler 2 to 4 GHz 10dB Type N	125.00
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C101	Variable Attenuator 0 to 60dB	200.00
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185B51	7.05 to 10 GHz Variable Attenuator 0 to 40dB	100.00
196C	8.2 to 12.4 GHz Variable Attenuator 0 to 45dB	100.00
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4060/2107 — 4K x 1 Dynamic RAM	3.99
4050/9050 — 4K x 1 Dynamic RAM	3.99
2111A-2/8111 — 256 x 4 Static RAM	3.99
2112A-2 — 256 x 4 Static RAM	3.99
2115AL-2 — 1K x 1 Static RAM 55ns	4.99
6104-3/4104 — 4K x 1 Static RAM 320ns	14.99
7141-2 — 4K x 1 Static RAM 200ns	14.99
MCM6641L20 — 4K x 2 Static RAM 200ns	14.99
9131 — 1K x 1 Static RAM 300ns	10.99

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A super high performance FM wireless mike kit! Transmits a stable signal up to 300 yards with exceptional audio quality by means of its built in electret mike. Kit includes case, mike, on-off switch, antenna, battery and super instructions. This is the finest unit available.

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Converts any TV to video monitor. Super stable, tunable over ch. 4-6. Runs on 5-15V, accepts std. video signal. Best unit on the market! Complete kit, VD-1 **$7.95**

Led Blinky Kit

A great attention getter which alternately flashes 2 jumbo LEDs. Use for name badges, buttons, warning panel lights, anything! Runs on 3 to 15 volts.
Complete kit, BL-1 **$2.95**

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A super sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as general purpose amplifier. Full 2 W rms output, runs on 6 to 15 volts, uses 8-45 ohm speaker.
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CPO-1

Runs on 3-12 Vdc 1 wall out, 1 KHZ good for CPO, Alarm, Audio Oscillator. Complete kit **$2.95**

FM Wireless Mike Kit

Transmits up to 300' to any FM broadcast radio, uses any type of mike. Runs on 3 to 9V. Type FM-2 has added sensitive mike preamp stage.

FM-1 kit **$3.95** FM-2 kit **$4.95**

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Tone Decoder

A complete tone decoder on a single PC board. Features: 400-5000 Hz adjustable range via 20 turn pot, voltage regulation, 567 IC. Useful for touch-tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts.
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Provides the basic parts and PC board required to provide a source of precision timing and pulse generation. Uses 555 timer IC and includes a range of parts for most timing needs.

UT-5 Kit **$5.95**

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Produces LOUD ear shattering and attention getting siren like sound. Can supply up to 15 watts of obnoxious audio. Runs on 6-15 VDC.

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Clock kit, 12/24 hour, DC-5 **$24.95**
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Alarm clock, 12 hour only, DC-8 **$29.95**
12V DC car clock, DC-7 **$29.95**

For wired and tested clocks add $10.00 to kit price.
SPECIFY 12 OR 24 HOUR FORMAT

Car Clock

The UN-KIT, only 5 solder connections

Here's a super looking, rugged and accurate auto clock, which is a snap to build and install. Clock movement is completely assembled — you only solder 3 wires and 2 switches, takes about 15 minutes! Display is bright green with automatic brightness control photocell — assures you of a highly readable display day or night. Comes in a satin finish anodized aluminum case which can be attached 5 different ways using 2 sided tape. Choice of silver, black or gold case (specify).

DC-3 kit, 12 hour format **$22.95**
DC-3 wired and tested **$29.95**

Calendar Alarm Clock

The clock that's got it all: 6- 5" LEDs, 12/24 hour, snooze, 24 hour alarm, 4 year calendar, battery backup, and lots more. The super 7001 chip is used. Size: 5x4x2 inches. Complete kit, less case (not available)
DC-9 **$34.95**

Under Dash Car Clock

12/24 hour clock in a beautiful plastic case features 6 jumbo RED LEDS, high accuracy (.001%), easy 3 wire hookup, display blanks with ignition, and super instructions. Optional dimmer atuomatically adjusts display to ambient light level.

DC-11 clock with mtg. bracket **$27.95 kit**
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Add $10.00 Assy. and Test

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RE 6416, terminal card kit (add $60.00 for wired unit) **$189.95**
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3900	$ .50
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5375AB/G	$ 2.95
7001	$ 6.50

CMOS

4011	.50
4013	.50
4046	$1.85
4049	.50
4059	$9.00
4511	$2.00
4518	$1.35
5639	$1.75

FERRITE BEADS

With info and specs. 15/$1.00
6 Hole Balun Beads 5/$1.00

READOUTS

FND 359 .4" C.C.	$1.00
FND 507/510 .5" C.A.	1.00
MAN 72/HP7730 .33" C.A.	1.00
HP 7851 .43" C.A.	2.00

Sockets

8 Pin	10/$2.00
14 Pin	10/$2.00
16 Pin	10/$2.00
24 Pin	4/$2.00
28 Pin	4/$2.00
40 Pin	3/$2.00

TRANSISTORS

2N3904 NPN C+F	15/$1.00
2N3906 PNP C+F	15/$1.00
2N4403 PNP C+F	15/$1.00
2N4410 NPN C+F	15/$1.00
2N4916 FET C+F	4/$1.00
2N5401 PNP C+F	5/$1.00
2N6028 C+F	4/$1.00
2N3771 NPN Silicon	$1.50
2N5179 UHF NPN	3/$2.00
Power Tab NPN 40W	3/$1.00
Power Tab PNP 40W	3/1.00
MPF 102/2N5484	$.50
NPN 3904 Type T+R	50/$2.00
PNP 3906 Type T+R	50/$2.50
2N3055	$.80
2N2646 UJT	3/$2.00

Diodes

5.1 V Zener	20/$1.00
1N914 Type	50/$1.00
1KV 2Amp	8/$1.00
100V 1Amp	15/$1.00

25 AMP 100V Bridge **$1.50 each**

Mini-Bridge 50V 1 AMP 2 for $1.00

Resistor Ass't

Assortment of Popular values - ¼ watt. Cut lead for PC mounting, ½" center, ½" leads, bag of 300 or more.
$1.50

Switches

Mini toggle SPDT **$1.00**
Red Pushbuttons N.O. **3/$1.00**

Earphones

3" leads, 8 ohm, good for small tone speakers, alarm clocks, etc.
5 for $1.00

Mini 8 ohm Speaker

Approx. 2¼" diam. Round type for radios, mike etc.
3 for $2.00

Solid State Buzzers

small buzzer 450 Hz, 86 dB, sound output on 5-12 vdc at 10-30 mA, TTL compatible **$1.50**

Slug Tuned Coils

Small 3/16" Hex. Slugs turned coil. 3 turns. 10 for $1.00

AC Outlet

Panel Mount with Leads
4/$1.00

CAPACITORS

TANTALUM Dipped Epoxy	ALUMINUM Electrolytic	DISK CERAMIC
1.5 uF 25V 3/$1.00	1000 uF 16V Radial $.50	.01 16V disk 20/$1.00
1.8 uF 25V 3/$1.00	500 uF 25V Axial $.50	.001 16V 20/$1.00
.22 uF 25V 3/$1.00	150 uF 16V Axial 5/$1.00	100 pF 20/$1.00
	10 uF 15V Radial 10/$1.00	.047 16V 20/$1.00

DC-DC Converter

+5 vdc input prod. -9 vdc @ 30ma
+9 vdc produces -15 vdc @ 35ma **$1.25**

Ceramic IF Filters

Mini ceramic filters 7 kHz B.W. 455 kHz $1.50 ea.

25K 20 Turn Trim Pot $1.00

1K 20 Turn Trim Pot $.50

Trimmer Caps

Sprague - 3-40 pf Stable Polypropylene .50 ea.

Crystal Microphone

Small 1" diameter ¼" thick crystal mike cartridge **$.75**

Mini RG-174 Coax

10 ft. for $1.00

Coax Connector

Chassis mount BNC type **$1.00**

9 Volt Battery Clips

Nice quality clips 5 for $1.00
¼" Rubber Grommets 10 for $1.00

Parts Bag

Asst. of chokes, disc caps, tant. resistors, transistors, diodes, MICA caps etc. sm. bag (100 pc) $1.00 lg. bag (300 pc) $2.00

Connectors

6 pin type gold contacts for mA-1003 car clock module price .75 ea.

Leds - your choice, please specify

Mini Red, Jumbo Red, High Intensity Red, Illuminator Red 8/$1
Mini Yellow, Jumbo Yellow, Jumbo Green 6/$1

Varactors

Motorola MV 2209 30 PF Nominal cap 20-80 PF - Tunable range - .50 each or 3/$1.00

Audio Prescaler

Make high resolution audio measurements, great for musical instrument tuning, PL tones, etc. Multiplies audio UP in frequency, selectable x10 or x100, gives .01 HZ resolution with 1 sec. gate time! High sensitivity of 25 mv, 1 meg input z and built-in filtering gives great performance. Runs on 9V battery, all CMOS.

PS-2 kit **$29.95**
PS-2 wired **$39.95**

600 MHz PRESCALER

Extend the range of your counter to 600 MHz. Works with all counters. Less than 150 mv sensitivity, specify -10 or -100

Wired, tested, PS-1B **$59.95**
Kit, PS-1B **$44.95**

30 Watt 2 mtr PWR AMP

Simple Class C power amp features 8 times power gain. 1 W in for 8 out, 2 W in for 15 out, 4W in for 30 out. Max output of 35 W, incredible value, complete with all parts, less case and T-R relay.

PA-1, 30 W pwr amp kit **$22.95**
TR-1, RF sensed T-R relay kit **6.95**

MRF-238 transistor as used in PA-1 8-10db gain 150 mhz **$11.95**

RF actuated relay senses RF (1W) and closes DPDT relay. For RF sensed T-R relay
TR-1 Kit **$6.95**

Power Supply Kit

Complete triple regulated power supply provides variable 6 to 18 volts at 200 ma and +5 at 1 Amp. Excellent load regulation, good filtering and small size. Less transformers, requires 6.3 V ct 1 A and 24 VCT.
Complete kit, PS-3LT **$6.95**

OP-AMP Special

BI-FET LF 13741 - Direct pin for pin 741 compatible, but 500,000 MEG input z, super low 50 pa input current, low power drain.
50 for only $9.00 **10 for $2.00**

Regulators

78MG	$1.25	7812	$1.00
79MG	$1.25	7815	$1.00
723	$.50	7905	$1.25
309K	$1.15	7912	$1.25
7805	$1.00	7915	$1.25

Shrink Tubing Nubs

Nice precut pces of shrink size: 1" x ¼" shrink to ⅛". Great for splices. 50/$1.00

Mini TO-92 Heat Sinks

Thermalloy Brand 5 for $1.00
To-220 Heat Sinks 3 for $1.00

Opto Isolators - 4N28 type **$.50 ea.**
Opto Reflectors - Photo diode + LED **$1.00 ea.**

Molex Pins

Molex already precut in length of 7. Perfect for 14 pin sockets. **20 strips for $1.00**

CDS Photocells

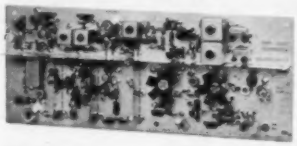
Resistance varies with light, 250 ohms to over 3 meg **3 for $1.00**

Quality VHF/UHF Kits at Affordable Prices~

These Low Cost SSB TRANSMITTING CONVERTERS

Let you use inexpensive recycled 10M or 2M SSB exciters on UHF & VHF!

- Linear Converters for SSB, CW, FM, etc.
- A fraction of the price of other units; no need to spend $300 – $400!
- Use with any exciter; works with input levels as low as 1 mW.
- Use low power tap on exciter or simple resistor attenuator pad (instructions included).
- Link osc with RX converter for transceive.



XV4 UHF KIT — ONLY $99.95

28-30 MHz in, 435-437 MHz out; 1W p.e.p. on ssb, up to 1½W on CW or FM. Has second oscillator for other ranges. Atten. supplied for 1 to 500 mW input, use external attenuator for higher levels.

Extra crystal for 432-434 MHz range.....$5.95
XV4 Wired and tested $149.95

XV2 VHF KIT - ONLY $69.95

2W p.e.p. output with as little as 1mW input. Use simple external attenuator. Many freq. ranges available.

MODEL	INPUT (MHz)	OUTPUT (MHz)
XV2-1	28-30	50-52
XV2-2	28-30	220-222
XV2-4	28-30	144-146
XV2-5	28-29 (27-27.4 CB)	145-146 (144-144.4)
XV2-7	144-146	50-52

XV2 Wired and tested $109.95

XV28 2M ADAPTER KIT - $24.95

Converts any 2M exciter to provide the 10M signal required to drive above 220 or 435 MHz units.

NEW! COMPLETE TRANSMITTING CONVERTER AND PA IN ATTRACTIVE CABINET

Far less than the cost of many 10W units!

Now, the popular Hamtronics® Transmitting Converters and heavy duty Linear Power Amplifiers are available as complete units in attractive, shielded cabinets with BNC receptacles for exciter and antenna connections. Perfect setup for versatile terrestial and OSCAR operations! Just right for phase 3! You save $30 when you buy complete unit with cabinet under cost of individual items. Run 40-45 Watts on VHF or 30-40 Watts on UHF with one integrated unit! Call for more details.

MODEL	KIT	WIRED and TESTED
XV2/LPA2-45/Cabt (6,2,or220)	$199.95	$349.95
XV4/LPA4-30/Cabt (for UHF)	$229.95	$399.95

Easy to Build FET RECEIVING CONVERTERS

Let you receive OSCAR and other exciting VHF and UHF signals on your present HF or 2M receiver

- NEW LOW-NOISE DESIGN
- ATTRACTIVE WOODGRAIN CASE
- Less than 2dB noise figure, 20dB gain

MODEL	RF RANGE	OUTPUT RANGE
CA28	28-32 MHz	144-148 MHz
CA50	50-52	28-30
CA50-2	50-54	144-148
CA144	144-146	28-30
CA145	145-147–or– 144-144.4	28-30 27-27.4 (CB)
CA146	146-148	28-30
CA220	220-222	28-30
CA220-2	220-224	144-148
CA110	Any 2MHz of Aircraft Band	26-28 or 28-30
CA432-2	432-434	28-30
CA432-5	435-437	28-30
CA432-4	432-436	144-148

Easily modified for other rf and if ranges.

STYLE	VHF	UHF
Kit less case	$34.95	$49.95
Kit with case	$39.95	$54.95
Wired/Tested in case	$54.95	$64.95

Professional Quality VHF/UHF FM/CW EXCITERS

- Double tuned circuits for spurious suppression
- Easy to align with built-in test aids

T51-30	10 Meter, 2W Kit	$44.95
T51-50	6 Meter, 2W Kit	$44.95
T51-150	2 Meter, 2W Kit	$44.95
T51-220	220 MHz, 2W Kit	$44.95
T450	450 MHz, 3/4W Kit	$44.95
T451	450 MHz, 3 W Kit	$59.95
A14T	5 Chan Adapter (T51&T451)	$9.95

See our Complete Line of VHF & UHF Linear PA's

- Use as linear or class C PA
- For use with SSB Xmtg Converters, FM Exciters, etc.

LPA2-15	6M, 2M, 220; 15 to 20W	$59.95
LPA2-30	6M, 2m; 25 to 30W	$89.95
LPA2-40	220 MHz; 30 to 40W	$119.95
LPA2-45	6M, 2M; 40 to 45W	$119.95
LPA4-10	430MHz; 10 to 14W	$79.95
LPA4-30	430MHz; 30-40W	$119.95

See catalog for complete specifications

FAMOUS HAMTRONICS PREAMPS

Let you hear the weak ones too!
Great for OSCAR, SSB, FM, ATV. Over 14,000 in use throughout the world on all types of receivers.

- NEW LOW-NOISE DESIGN
- Less than 2 dB noise figure, 20 dB gain
- Case only 2 inches square
- Specify operating frequency when ordering

MODEL P-30 VHF PREAMP, available in many versions to cover bands 28-300 MHz.

MODEL P432 UHF PREAMP, available in versions to cover bands 300-650 MHz.

STYLE	VHF	UHF
Kit less case	$12.95	$18.95
Kit with case	$18.95	$26.95
Wired/Tested in Case	$27.95	$32.95

NEW VHF/UHF FM RCVRS

Offer Unprecedented Range of Selectivity Options

- New generation
- More sensitive
- More selective
- Low cross mod
- Uses crystal filters
- Smaller
- Easy to align

R75A* VHF Kit for monitor or weather sattelite service. Uses wide L-C filter. -60dB at ± 30 kHz.....$69.95

R75B* VHF Kit for normal nbfm service. Equivalent to most transceivers. -60dB at ± 17 kHz, -80dB at ± 25 kHz....$74.95

R75C* VHF Kit for repeater service or high rf density area. -60dB at ±14kHz, -80dB ±22kHz, -100dB ±30kHz....$84.95

R75D* VHF Kit for split channel operation or repeater in high density area. Uses 8-pole crystal filter. -60dB at ±9 kHz, -100dB at ± 15 kHz. The ultimate receiver!....$99.95

* Specify band: 10M, 6M, 2M, or 220 MHz. May also be used for adjacent commercial bands. Use 2M version for 137 MHz WX satellites.

R450( ) UHF FM Receiver Kits, similar to R75, but for UHF band. New low-noise front end. Add $10 to above prices. (Add selectivity letter to model number as on R75.)

A14 5 Channel Adapter for Receivers.....$9.95

NEW R110 VHF AM RCVR

AM monitor receiver kit similar to R75A, but AM. Available for 10-11M, 6M, 2M, 220 MHz, and 110-130 MHz aircraft band $74.95. (Also available in UHF version.)

IT'S EASY TO ORDER!

- Write or phone 716-392-9430
(Electronic answering service evenings & weekends)
- Use Credit Card, UPS COD, Check, Money Order
- Add $2.00 shipping & handling per order

Call or Write to get ✓33
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With Complete Details
(Send 4 IRC's for overseas mailing)

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MEMORY

	Description	Price
2708	1K x 8 Eprom	$ 5.00
2716/2516	2K x 8 5V single supply	9.99
2114/9114	1K x 4 Static	5.00
4027	4K x 1 Dynamic Ram	2.99
2117/4116	16K x 1 Dynamic Ram	5.00
2732-6	32K Eprom	39.95

C.P.U.'s, Etc.

MC6800P	Microprocessor	9.99
MC6821P	PIA	6.99
MC6845P	CRT Controller	25.00
MC6850P	ACIA	4.99
MC6852P	SSDA	5.00
8008-1	Microprocessor	5.00
8080A	Microprocessor	5.00
Z80A	Microprocessor	10.99
Z80	Microprocessor	8.99
Z80A	PIO	9.99
Z80	SIO/0	22.50
Z80	SIO/1	22.50
8212	8 Bit input/output part	3.99
8251	Communication Interface	6.99
TR1602/AY5-1013	UART	6.99
TMS1000NL	Four Bit Microprocessor	4.99
PT1482B	PSAT	5.99
8257	DMA Controller	8.99
3341	64 x 4 FIFO	3.00
MM5316/F3817	Clock with alarm	5.99
8741		60.00
8748	8 Bit Microcomputer with programmable/ erasable EPROM	60.00
MC1408L/6	6 Bit D/A	3.25
COM2502		9.99
COM2601		9.99

CRYSTAL FILTERS
TYCO 001-19880 Same as 2194F
10.7 MHz narrow band
3 dB bandwidth 15 KHz min.
20 dB bandwidth 60 KHz min.
40 dB bandwidth 150 KHz min.
Ultimate 50 dB insertion loss 1 dB max.
Ripple 1 dB max. Ct. 0+/-5 pf 3600 Ohms
$3.99 each

MRF454, same as MRF458 12.5 VDC, 3-30 MHz
80 Watts output, 12 dB gain $17.95 each

MRF472
12.5 VDC, 27 MHz
4 Watts output, 10 dB gain
$1.69 each

CARBIDE CIRCUIT BOARD DRILL BITS
for PCB Boards
5 mix for $5.00

MURATA CERAMIC FILTERS

SFD 455D	455 KHz	$2.00
SFB 455D	455 KHz	1.60
CFM 455E	455 KHz	5.50
SFE 10.7 MA	10.7 MHz	2.99

ATLAS CRYSTAL FILTERS FOR ATLAS HAM GEAR
5.52 - 2.7/8
5.595 - 2.7/8/U
5.645 - 2.7/8
5.595 - .500/4/CW
5.595 - 2.7 USB
5.595 - 2.7/8/L
5.595 - 2.7 LSB
9.0 - USB/CW
YOUR CHOICE $12.99 each

J310 N-CHANNEL J-FET 450 MHz
Good for VHF/UHF Amplifier, Oscillator and Mixers 3/$1.00

AMPHENOL COAX RELAY
26 VDC Coil SPDT #360-11892-13
100 Watts Good up to 18 GHz
$19.99 each

78M05 Same as 7805 but only ½ Amp @ 5 VDC 49¢ each or 10/$3.00

NEW TRANSFORMERS

F-18X	6.3 VCT @ 6 Amps	$6.99 ea.
F-46X	24 V @ 1 Amp	5.99 ea.
F-41X	25.2 VCT @ 2 Amps	6.99 ea.
P-8380	10 VCT @ 3 Amps	7.99 ea.
P-8604	20 VCT @ 1 Amp	4.99 ea.
P-8130	12.6 VCT @ 2 Amps	4.99 ea.
K-32B	28 VCT @ 100 MA	4.99 ea.
E30554	Dual 17V @ 1Amp ea.	6.99 ea.

EIMAC FINGER STOCK #Y-302
36 in. long x ½ in. $4.99 each

NO ORDERS UNDER $10

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MRF203	$P.O.R.
MRF216	19.47
MRF221	8.73
MRF226	10.20
MRF227	2.13
MRF238	10.00
MRF240	14.62
MRF245	28.87
MRF247	28.87
MRF262	6.25
MRF314	12.20
MRF406	11.33
MRF412	20.65
MRF421	27.45
MRF422A	38.25
MRF422	38.25
MRF428	38.25
MRF428A	38.25
MRF426	8.87
MRF426A	8.87
MRF449	10.61
MRF449A	10.61
MRF450	11.00
MRF450A	11.77
MRF452	15.00
MRF453	13.72
MRF454	21.83
MRF454A	21.83
MRF455	14.08
MRF455A	14.08
MRF472	2.50
MRF474	3.00
MRF475	2.90
MRF476	2.25
MRF477	10.00
MRF485	3.00
MRF492	20.40
MRF502	.93
MRF604	2.00
MRF629	3.00
MRF648	26.87
MRF901	3.99
MRF902	9.41
MRF904	3.00
MRF911	4.29
MRF5176	11.73
MRF8004	1.39
BFR90	1.00
BFR91	1.25
BFR96	1.50

BFW92A	$ 1.00
BFW92	.79
MMCM918	14.30
MMCM2222	15.65
MMCM2369	15.00
MMCM2484	15.25
MMCM3960A	24.30
MWA110	6.92
MWA120	7.38
MWA130	8.08
MWA210	7.46
MWA220	8.08
MWA230	8.62
MWA310	8.08
MWA320	8.62
MWA330	9.23

TUBES

6KD6	$ 5.00
6LQ6/6JE6	6.00
6MJ6/6LQ6/6JE6C	6.00
6LF6/6MH6	5.00
12BY7A	4.00
2E26	4.69
4X150A	29.99
4CX250B	45.00
4CX250R	69.00
4CX300A	109.99
4CX350A/8321	100.00
4CX350F/J/8904	100.00
4CX1500B/8660	300.00
811A	20.00
6360	4.69
6939	7.99
6146	5.00
6146A	5.69
6146B/8298	7.95
6146W	12.00
6550A	8.00
8908	9.00
8950	9.00
4-400A	71.00
4-400C	80.00
572B/T160L	44.00
7289	9.95
3-1000Z	229.00
3-500Z	129.99

TO-3 TRANSISTOR SOCKETS
Phenolic type 6/$1.00

UHF/VHF RF POWER TRANSISTORS
CD2867/2N6439
60 Watts output
Reg. Price $45.77
SALE PRICE $19.99

1900 MHz to 2500 MHz DOWNCONVERTERS
Intended for amateur radio use
Tunable from channel 2 thru 6
34 dB gain 2.5 - 3 dB noise
Warranty for 6 months
Model HMR II with dish antenna
Complete Receiver and Power Supply
$225.00 (does not include coax)
4 foot Yagi antenna only
$39.99
Downconverter Kit - PCB and parts
$69.95
Power Supply Kit - Box, PCB and parts
$49.99
Downconverter assembled
$79.99
Power Supply assembled
$59.99
Complete Kit with Yagi antenna
$109.99

REPLACEMENT PARTS

MRF901	$ 3.99
MBD101	1.29
.001 Chip Caps	1.00
Power supply PCB	4.99
Downconverter PCB	19.99

Bogner down converter, industrial version. 1 year guarantee $225.00

86 PIN MOTOROLA BUS EDGE CONNECTORS
Gold plated contacts
Dual 43/86 pin .156 spacing
Solder tail for PCB $3.00 each

CONTINUOUS TONE BUZZERS
12 VDC $2.00 each

110 VAC MUFFIN FANS
New $11.95 Used $5.95

PL-259 TERMINATION 52 Ohm 5 Watts
$1.50 each

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2N2949	3.60
2N2947	15.00
2N2950	4.60
2N3375	8.00
2N3553	1.57
2N3818	5.00
2N3866	1.00
2N3866JAN	2.50
2N3866JANTX	4.00
2N3925	10.00
2N3948	2.00
2N3950	25.00
2N3959	3.00
2N3960JANTX	10.00
2N4072	1.60
2N4427	1.10
2N4429	7.00
2N4877	1.00
2N4959	2.00
2N4976	15.00
2N5070	8.00
2N5071	15.00
2N5108	4.00
2N5109	1.50
2N5179	1.00
2N5583	4.00
2N5589	6.00
2N5590	8.00
2N5591	11.00
2N5635	5.44
2N5636	11.60
2N5637	20.00
2N5641	5.00
2N5643	14.00
2N5645	10.00
2N5842	8.00
2N5849	20.00
2N5942	40.00
2N5946	14.00
2N5862	50.00
2N6080	7.00
2N6081	10.00
2N6082	11.00
2N6083	13.00
2N6084	14.00
2N6095	11.00
2N6096	20.00
2N6097	$28.00
2N6166	38.00
2N6368	22.99
2N6439	40.00
A210/MRF517	2.00
BLY38	5.00
40280/2N4427	1.10
40281/2N3920	7.00
40282/2N3927	10.48

NE555V TIMERS
39¢ each or 10/$3.00

NEW DUAL COLON LED
69¢ each or
10/$5.00

HEP170 1000 PIV
2.5 Amps 25¢ each or
100/$15.00

HIGH VOLTAGE CAPS
420 MFD @ 400 VDC OR
600 MFD @ 400 VDC
$6.99 each

NEW ROTRON BISCUIT FANS
Model BT2A1 115 VAC
$12.99 each

TORIN TA700 FANS NEW
Model A30340
230 VAC @ .78 Amps
Will also work on 115 VAC
$29.99 each

DOOR KNOB CAPS

470 pf @ 15 KV	$3.99 each
Dual 500 pf @ 15 KV	5.99 each
680 pf @ 6 KV	3.99 each
800 pf @ 15 KV	3.99 each
1000 pf @ 20 KV	5.00 each
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NEW & USED BCD SWITCHES
3 switch with end plates
New $8.99
Used $6.95

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Check, money order, or credit cards welcome. (Mastercharge and VISA only) No personal checks or certified personal checks for foreign countrys accepted. Money order or cashiers check in U.S. funds only. Letters of credit are not acceptable.

Minimum shipping by UPS is $2.35 with insurance. Please allow extra shipping charges for heavy or long items.

All parts returned due to customer error will be subject to a 15% restock charge.

If we are out of an item ordered, we will try to replace it with an equal or better part unless you specify not to, or we will back order the item, or refund your money.

PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE. Prices superseade all previously published. Some items offered are limited to small quantities and are subject to prior sale.

We now have a toll free number but we ask that it be used for CHARGE ORDERS ONLY. If you have any questions please use our other number. We are open from 8:00 a.m. - 5:00 p.m. Monday thru Saturday.

Our toll free number for orders only is 800-528-3611.

JUMBO LED's		MEDIUM LED's	
Red	8/$1.00	Red	6/$1.00
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Yellow	6/$1.00		
Green	6/$1.00		
Amber	6/$1.00		

NEW G.E. OPTO COUPLERS 4N26
69¢ each or 10/$5.00

MICRO-MINI WATCH CRYSTALS
32.768 Hz $3.00 each

NEW 2 inch ROUND SPEAKERS
100 Ohm coil 99¢ each

PLASTIC TO-3 SOCKETS 4/$1.00

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INTRODUCING SONY'S NEW DIGITAL DIRECT ACCESS RECEIVER!

only **$299.95** plus $5.00 shipping

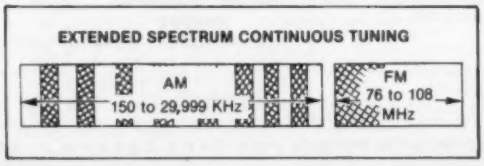
Revolutionary Direct Access Digital Shortwave Scanner

- **Continuous Scanning of LW, MW, SW, & FM Bands**
- **Instant Fingertip Tuning—No More Knobs!**
- **6 Memories for Any Mode (AM,SSB/CW, & FM)**
- **Dual PLL Frequency Synthesized—No Drift!**

A WHOLE NEW BREED OF RADIO IS HERE NOW! No other short wave receiver combines so many advanced features for both operating convenience and high performance as does the new Sony ICF-2001. Once you have operated this exciting new radio, you'll be spoiled forever! Direct access tuning eliminates conventional tuning knobs and dials with a convenient digital keyboard and Liquid Crystal Display (LCD) for accurate frequency readout to within 1 KHz. Instant fingertip tuning, up to 8 memory presets, and continuous scanning features make the ICF-2001 the ultimate in convenience.

Compare the following features against any receiver currently available and you will have to agree that the Sony ICF 2001 is the best value in shortwave receivers today:

DUAL PLL SYNTHESIZER CIRCUITRY covers entire 150 KHz to 29.999 MHz band. PLL_1 circuit has 100 KHz step while PLL_2 handles 1 KHz step, both of which are controlled by separate quartz crystal oscillators for precise, no-drift tuning. **DUAL CONVERSION SUPERHETERODYNE** circuitry assures superior AM reception and high image rejection characteristics. The 10.7 MHz IF of the FM band is utilized as the 2nd IF of the AM band. A new type of crystal filter made especially for this purpose realizes clearer reception than commonly used ceramic filters. **ALL FET FRONT END** for high sensitivity and interference rejection. Intermodulation, cross modulation, and spurious interference are effectively rejected. **FET RF AMP** contributes to superior image rejection, high sensitivity, and good signal to noise ratio. Both strong and weak stations are received with minimal distortion.



A Enter Button
B Signal Strength Indicator
C Liquid Crystal Display
D Memory Preset Buttons
E Antenna Adjustment Dial
F SSB/CW Compensator
G Execute Bar
H Manual Tuning Buttons
I Scan Button
J High/Low Limit Buttons

OPERATIONAL FEATURES

INSTANT FINGERTIP TUNING with the calculator-type key board enables the operator to have instant access to any frequency in the LW, MW, SW, and FM bands. And the LCD digital frequency display confirms the exact, drift-free signal being received. **AUTOMATIC SCANNING** of the above bands. Continuous scanning of any desired portion of the band is achieved by setting the "L_1" and "L_2" keys to define the range to be scanned. The scanner can stop automatically on strong signals, or it can be done manually. **MANUAL SEARCH** is similar to the manual scan mode and is useful for quick signal searching. The "UP" and "DOWN" keys let the tuner search for you. The "FAST" key increases the search rate for faster signal detection. **MEMORY PRESETS.** Six memory keys hold desired stations for instant one-key tuning in any mode (AM, SSB/CW, and FM), and also, the "L_1" and "L_2" keys can give you two more memory slots when not used for scanning. **OTHER FEATURES:** Local, normal, DX sensitivity selector for AM; SSB/CW compensator; 90 min. sleep timer; AM Ant. Adjust.

SPECIFICATIONS

CIRCUIT SYSTEM: Fm Superheterodyne; AM Dual conversion superheterodyne. **SIGNAL CIRCUITRY:** 4 IC's, 11 FET's, 23 Transistors, 16 Diodes. **AUXILIARY CIRCUITRY:** 5 IC's, 1 LSI, 5 LED's, 25 Transistors, 9 Diodes. **FREQUENCY RANGE:** FM 76-108 MHz; AM 150-29,999 KHz. **INTERMEDIATE FREQUENCY:** FM 10.7 MHz.; AM 1st 66.35 MHz., 2nd 10.7 MHz. **ANTENNAS:** FM telescopic, ext. ant. terminal; AM telescopic, built-in ferrite bar, ext. ant. terminal. **POWER:** 4.5 VDC/120 VAC **DIMENSIONS:** 12¼ (W) X 2¼ (H) X 6¾ (D). **WEIGHT:** 3 lb. 15 oz. (1.8 kg)

SPECTRONICS, INC.
1009 GARFIELD ST. OAK PARK, IL. 60304

PHONE
(312)848-6777

BULLET ELECTRONICS

P.O. Box 401244-E Garland, TX. 75040 (214) 278-3553

The Greatest Breakthrough In Electronic Music Ever!

New! **The Super Music Maker**

REVISION 2

$24.95

(Basic Kit)

Does not include speaker switches or 2708 ROM.

Now you can play hundreds of songs using the Bullet **Super Music Maker.** The unit **features a single factory programmed microprocessor IC** that comes with 20 pre-programmed short tunes. By adding the additional PROMS (2708's) the system can be expanded to play up to **1000 notes per PROM.** Just think . . . a compact electronic instrument that will play dozens, hundreds or even thousands of selections of music. The kit comes with **all electronic components (less the PROM),** and a drilled, plated and screened PC Board which measures 4" x 4¾". The **7 watt amplifier** section is on the same PC board and drives an 8 ohm speaker (not included), from a whisper to ear splitting volume. Since the unit works on **12 VDC** or **12 VAC°,** vehicle or portable operation is possible. **What do you get for $24.95? Everything but a speaker, transformer, case, switches,** and **PROM.** Additional 2708 albums containing popular tunes are available for **$15.00** each or you can program your own PROMS using information provided with the kit instructions. Lists of available PROM albums are available on request. *(Note: Unit plays electronic music one note at a time, it is not possible to play chords or a melody with harmony simultaneously.)*

- ★ Envelope control gives decay to notes.
- ★ "Next tune" feature allows sequential playing of all songs.
- ★ On board inverter allows single voltage (+12) operation.

OPTIONAL ACCESSORIES

DIP Switches One 8 pos., One 5 pos. **2.00/Set**
(Can be **directly soldered** to PC Bd. to access tunes)

Rotary Switches Two 5 position **2.00/Set**
(For **remote wiring** to PC Bd. to access tunes)

Attractive Black Plastic Case **6.50**

Wallplug Transformer **3.00**
(For operation on 117VAC house voltage)

Super Value Power Transformer

Well made, open frame transformer with mounting ears. Build a +5 and ±12 supply with inexpensive parts. **Free schematics of several designs. Primary 117VAC. SEC #1** 15VAC @ .5A **SEC #2** 15 VAC @ .5A **SEC #3** 8VAC @ 2.5A. **$2.95**

ORDER: BET-0005

7 Watt Audio Amp Kit $5.95

SMALL, SINGLE, HYBRID IC AND COMPONENTS FIT ON A 2" x 3" PC BOARD (INCLUDED). RUNS ON 12 VDC. GREAT FOR ANY PROJECT THAT NEEDS AN INEXPENSIVE AMP. LESS THAN 3% THD @ 5 WATTS. COMPATIBLE WITH SE-01 SOUND KIT.

Overvoltage Protection Kit $6.95

Protect your expensive equipment from overvoltage conditions. Every computer should have one! **Works with any fused DC power source** from 10 to 20 volts up to 25 amps.

AY3-8910 PROGRAMMABLE SOUND GENERATOR

The AY3-8910 is a 40 pin LSI chip with three oscillators, three amplitude controls, programmable noise generator, three mixers, an envelope generator, and three D/A converters that are controlled by 8 BIT WORDS. No external pots or caps required. This chip hooked to an 8 bit microprocessor chip or Buss (8080, Z80, 6800 etc.) can be software controlled to produce almost any sound. It will play three note chords, make bangs, whistles, sirens, gunshots, explosions, bleets, whines, or grunts. In addition, it has provisions to control its own memory chips with two IO ports. The chip requires +5V @ 75ma and a standard TTL clock oscillator. A truly incredible circuit.

12.95 W/Basic Spec Sheet (4 pages)
60 page manual with S-100 interface instructions and several programming examples, **$3.00 extra**

ZULU II CLOCK KIT X-RATED!

WITH CALENDAR AND NOX™ CIRCUIT

X-TRA VALUE: All the components and high quality plated G-10 PC Boards are provided.
X-TRA CARE IN DESIGN: Easy Assembly! Large open layout.
X-CELLENCE IN IDEAS: 5 years of designed products for the amateur radio market.
X-CELLENCE IN INSTRUCTIONS: Clear step-by-step instructions with quality illustrations and schematic.
X-TRA FEATURES: There has never been a clock kit with so many features — at any price!

- Unit operates on either **12 VAC** or **12 VDC.**
- On board **QUARTZ XTAL TIMEBASE** or 60Hz AC line freq. can be used.
- Automatic **BATTERY BACKUP***
- Reads true **24 HOUR TIME** and **31 DAY CALENDAR.**
- **Unique NOX™ CIRCUIT activates readouts with a handclap followed by the date for 4 seconds. Or they can be turned on constantly.**
- When used mobile readouts blank whe ignition is off.
- Special **NOISE SUPPRESSION** and battery reversal circuits.
- Bright 1/2" LED's show hours, minute and seconds.

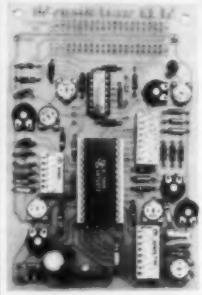
19.95
LESS CASE

ACCESSORIES

Custom High Impact Molded Case with Ruby Lens. Available in Blue or Tan.
$6.50

117 VAC to 12 VAC Transformer.
$1.35

*9V Battery Not Included



Sound Effects Kit 18.50

The **SE-01 Sound Effects Kit** is a complete kit; all you need to build a programmable sound effects machine except a battery and speaker. Our kit is designed to really ring out the **TI 76477** Sound Chip. Only the SE-01 provides you with additional circuitry that includes a **PULSE GENERATOR, MUX OSCILLATOR and COMPARITOR** to make more complex sounds a snap. We help you in building the kit with a clear, easy-to-follow construction manual and we show you how to easily program the unit. Other dealers will sell you the chip or a "kit" of parts but you are on your own to do the most difficult part...make neat sounds! Within a short time after you build the SE-01 you can easily create **Gunshots, Explosions, Space Sounds, Steam Trains** and much more. We think the Bullet SE-01 is the best deal on the market but don't ask us, — ask the **15,000** happy SE-01 owners!

Complete Kit With Quality Plated PC Board **$18.50**
(Less battery & speaker)

AUTO/VAN CLOCK KIT 16.95

- 12 Hr. Format
- 6 Digit ½" LED Readouts
- Quartz XTAL Timebase
- Alarm & Snooze Options
- Noise Filtering
- Easy Assembly • 12 VDC
- 4 5/8" x 3" x 1 1/2"
- All Parts!

ULTRASONIC RELAY KIT

Invisible Beam Works Like A Photo Electric Eye. **COMPLETE KIT** . All Parts & PC Board. Use Up To 25 Ft. Apart.
$21.50

Optional entry delay and Alarm Timeout Circuit will source or sink up to 200 MA DC.
$3.95

PARTS

LM3046	(CA3046) Xistor Array	.75
RCA 40430	400V 6A TRIAC TO-66	.75
LM567	Tone Decoder	.99
CD4046	PLL CMOS	.99
LM3302	Quad Comparator	.89
2SC 1949	High Freq. NPN TO-92	6/1.00
MPS A 20	NPN General Purpose	6/1.00
TL490	Bar/Graph Driver w/specs	2.50
7812	12V 1A Regulator	.99
7805	5V 1A Regulator	.99
78M05	5V ½A Reg. TO-5 (Hse #)	.60
LM3911	Temp. Transducer w/specs	1.10
555	Timer IC	.49
2N6028	P.U.T. w/specs	.50
IL-1	Opto Isolator w/specs	.60
LM377	Dual LM380 w/specs	1.09
TIP-30	PNP Power TO-220	3/1.00
SCR	Sensitive Gate 200V 4A	7/1.00
SCR	Sensitive Gate 600V 4A RCA	3/1.00
GE ST-2 DIAC	Trigger diode for triacs in AC phase control operation	.29

TO-3 P.C. BOARD HEATSINK

Perfect for power transistors, or 309 and 340K series voltage regulators.

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Thermoloy H6014 Black Anodized

THE PERFECT TRANSFORMER

117VAC primary. 12VAC secondary @ 200ma Great for all your CMOS, or low power TTL projects. PC board mount. ***ORDER:***
99¢ ea. 3/$2.50 *XFMR 03*
Size: 1.5" W x 1.25" D x 1.25" H

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115W NPN POWER TRANSISTOR TO-3

Most popular transistor for power supplies, audio amps, switching, etc.

Limit 20 per customer **50¢ Each**

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ramsey the first name in Counters !

9 DIGITS 600 MHz $129.95 WIRED

PRICES

CT-90 wired, 1 year warranty	$129.95
CT-90 Kit, 90 day parts warranty	109.95
AC-1 AC adapter	3.95
BP-1 Nicad pack + AC Adapter/Charger	12.95
OV-1, Micro-power Oven time base	49.95
External time base input	14.95

The CT-90 is the most versatile, feature packed counter available for less than $300.00! Advanced design features include; three selectable gate times, nine digits, gate indicator and a unique display hold function which holds the displayed count after the input signal is removed! Also, a 10mHz TCXO time base is used which enables easy zero beat calibration checks against WWV. Optionally; an internal nicad battery pack, external time base input and Micro-power high stability crystal oven time base are available. The CT-90, performance you can count on!

SPECIFICATIONS:

Range:	20 Hz to 600 MHz
Sensitivity:	Less than 10 MV to 150 MHz Less than 50 MV to 500 MHz
Resolution:	0.1 Hz (10 MHz range) 1.0 Hz (60 MHz range) 10.0 Hz (600 MHz range)
Display:	9 digits 0.4" LED
Time base:	Standard-10.000 mHz, 1.0 ppm 20-40°C. Optional Micro-power oven-0.1 ppm 20-40°C
Power:	8-15 VAC @ 250 ma

7 DIGITS 525 MHz $99.95 WIRED

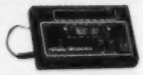
SPECIFICATIONS:

Range:	20 Hz to 525 MHz
Sensitivity:	Less than 50 MV to 150 MHz Less than 150 MV to 500 MHz
Resolution:	1.0 Hz (5 MHz range) 10.0 Hz (50 MHz range) 100.0 Hz (500 MHz range)
Display:	7 digits 0.4" LED
Time base:	1.0 ppm TCXO 20-40°C
Power:	12 VAC @ 250 ma

The CT-70 breaks the price barrier on lab quality frequency counters. Deluxe features such as; three frequency ranges - each with pre-amplification, dual selectable gate times, and gate activity indication make measurements a snap. The wide frequency range enables you to accurately measure signals from audio thru UHF with 1.0 ppm accuracy - that's .0001%! The CT-70 is the answer to all your measurement needs, in the field, lab or ham shack.

PRICES:

CT-70 wired, 1 year warranty	$99.95
CT-70 Kit, 90 day parts warranty	84.95
AC-1 AC adapter	3.95
BP-1 Nicad pack + AC adapter/charger	12.95



7 DIGITS 500 MHz $79.95 WIRED

PRICES:

MINI-100 wired, 1 year warranty	$79.95
MINI-100 Kit, 90 day part warranty	59.95
AC-Z Ac adapter for MINI-100	3.95
BP-Z Nicad pack and AC adapter/charger	12.95

Here's a handy, general purpoee counter that provides most counter functions at an unbelievable price. The MINI-100 doesn't have the full frequency range or input impedance qualities found in higher price units, but for basic RF signal measurements, it can't be beat! Accurate measurements can be made from 1 MHz all the way up to 500 MHz with excellent sensitivity throughout the range, and the two gate times let you select the resolution desired. Add the nicad pack option and the MINI-100 makes an ideal addition to your tool box for "in-the-field" frequency checks and repairs.

SPECIFICATIONS:

Range:	1 MHz to 500 MHz
Sensitivity:	Less than 25 MV
Resolution:	100 Hz (slow gate) 1.0 KHz (fast gate)
Display:	7 digits, 0.4" LED
Time base:	2.0 ppm 20-40°C
Power:	5 VDC @ 200 ma

8 DIGITS 600 MHz $159.95 WIRED

NEW READ RECEIVER FREQUENCY

SPECIFICATIONS:

Range:	20 Hz to 600 MHz
Sensitivity:	Less than 25 mv to 150 MHz Less than 150 mv to 600 MHz
Resolution:	1.0 Hz (60 MHz range) 10.0 Hz (600 MHz range)
Display:	8 digits 0.4" LED
Time base:	2.0 ppm 20-40°C
Power:	110 VAC or 12 VDC

The CT-50 is a versatile lab bench counter that will measure up to 600 MHz with 8 digit precision. And, one of its best features is the Receive Frequency Adapter, which turns the CT-50 into a digital readout for any receiver. The adapter is easily programmed for any receiver and a simple connection to the receiver's VFO is all that is required for use. Adding the receiver adapter in no way limits the operation of the CT-50, the adapter can be conveniently switched on or off. The CT-50, a counter that can work double-duty!

PRICES:

CT-50 wired, 1 year warranty	$159.95
CT-50 Kit, 90 day parts warranty	119.95
RA-1, receiver adapter kit	14.95
RA-1 wired and pre-programmed (send copy of receiver schematic)	29.95

DIGITAL MULTIMETER $99.95 WIRED

PRICES:

DM-700 wired, 1 year warranty	$99.95
DM-700 Kit, 90 day parts warranty	79.95
AC-1, AC adaptor	3.95
BP-3, Nicad pack +AC adapter/charger	19.95
MP-1, Probe kit	2.95

The DM-700 offers professional quality performance at a hobbyist price. Features include; 26 different ranges and 5 functions, all arranged in a convenient, easy to use format. Measurements are displayed on a large 3½ digit, ½ inch LED readout with automatic decimal placement, automatic polarity, overrange indication and overload protection up to 1250 volts on all ranges, making it virtually goof-proof! The DM-700 looks great, a handsome, jet black, rugged ABS case with convenient retractable tilt bail makes it an ideal addition to any shop.

SPECIFICATIONS:

DC/AC volts:	100uV to 1 KV, 5 ranges
DC/AC current	0.1uA to 2.0 Amps, 5 ranges
Resistance:	0.1 ohms to 20 Megohms, 6 ranges
Input impedance:	10 Megohms, DC/AC volts
Accuracy:	10.1% basic DC volts
Power:	4 'C' cells

AUDIO SCALER

For high resolution audio measurements, multiplies UP in frequency.

- Great for PL tones
- Multiplies by 10 or 100
- 0.01 Hz resolution!

$29.95 Kit $39.95 Wired

ACCESSORIES

Telescopic whip antenna - BNC plug	$ 7.95
High impedance probe, light loading	15.95
Low pass probe, for audio measurements	15.95
Direct probe, general purpose usage	12.95
Tilt bail, for CT 70, 90, MINI-100	3.95
Color burst calibration unit, calibrates counter against color TV signal	14.95

COUNTER PREAMP

For measuring extremely weak signals from 10 to 1,000 MHz. Small size, powered by plug transformer-included.

- Flat 25 db gain
- BNC Connectors
- Great for sniffing RF with pick-up loop

$34.95 Kit $44.95 Wired

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NEW Products!

Chances are the police, fire and weather emergencies you'll read about in tomorrow's paper are coming through on a *Bearcat* scanner right now. *Bearcat* scanners bring the real live excitement of action news into your home or car. With a *Bearcat* scanner you can monitor the exciting two-way radio conversations of police and fire departments, intelligence agencies, mobile telephones, energy/oil exploration crews, and more.

Some *Bearcat* scanners can even monitor aircraft transmissions! You can actually hear the news *before* it's news. If you do not own a *Bearcat* scanner for yourself, now's the time to buy your scanner from **Communications Electronics**. Choose the *Bearcat* scanner that's right for you, then call our *toll-free* number to place your order with your Visa or Master Charge.

We give you excellent service, because **CE** distributes more scanners worldwide than *anyone* else. Our warehouse facilities are equipped to process thousands of scanner orders every week. We also export scanners to over 300 countries and military installations. Almost all items are **in stock** for **quick shipment**, so if you're a person who prefers fact to fantasy and who needs to know what's *really* happening around you, order your *Bearcat* brand scanner today from **Communications Electronics**.

Bearcat® 300

The Ultimate Synthesized Scanner!
List price $549.95/**CE price $349.00**
4-Band, 50 Channel • Service Search • No-crystal scanner • AM Aircraft and Public Service bands. • Priority Channel • AC/DC
Bands: 32-50, 118-136 AM, 144-174, 421-512 MHz.
The *Bearcat* 300 is the most advanced automatic scanning radio that has ever been offered to the public. Since the *Bearcat* 300 has over 2,100 active frequencies in memory, you can touch one button and search any of many preprogrammed services such as police, fire, aircraft and government. Of course, you still can program your own frequencies and monitor up to 50 channels at once. Since the *Bearcat* 300 uses a bright green fluorescent digital display, it's ideal for mobile applications. The *Bearcat* 300 now has these added features: Service Search, Display Intensity Control, Hold Search and Resume Search keys, Separate Band keys to permit lock-in/lock-out of any band for more efficient service search.

Bearcat® 250

List price $429.95/**CE price $279.00**
50 Channels • Crystalless • Searches Stores • Recalls • Digital clock • AC/DC Priority Channel • 3-Band • Count Feature.
Frequency range 32-50, 146-174, 420-512 MHz.
The *Bearcat* 250 performs any scanning function you could possibly want. With push button ease you can program up to 50 channels for automatic monitoring. Push another button and search for new frequencies. There are no crystals to limit what you want to hear. A special search feature of the *Bearcat* 250 actually stores 64 frequencies and recalls them, one at a time, at your convenience. Automatic "count" remembers how often frequencies are activated by transmission — so you know where the action is. Decimal display shows the channel, frequency and other programmed features.

NEW! **Bearcat 160**

Bearcat® 220

List price $449.95/**CE price $289.00**
Aircraft and public service monitor. *Frequency range 32-50, 118-136 AM, 144-174, 420-512 MHz.*
The *Bearcat* 220 is one scanner which can monitor all public service bands plus the exciting AM aircraft band channels. Up to twenty frequencies may be scanned at the same time.

Not only does this new scanner feature normal search operation, where frequency limits are set and the scanner searches between your programmed parameters, it also searches marine or aircraft frequencies by pressing a single button. These frequencies are already stored in memory so no reprogramming is required. The *Bearcat* 220 is crystalless and features push button programming of desired frequencies. A decimal display indicates channels, frequencies and operations as progammed into the scanner. The lockout feature lets you skip frequencies not of current interest. The *Bearcat* 220 also features a Priority channel, Dual scanning speeds, Patented track tuning, Direct channel access and AC/DC operation.

NEW! Bearcat® 210XL

List price $349.95/**CE price $229.00**
16 Channels • 3 Bands • Crystalless • AC/DC
Frequency range: 32-50, 144-174, 421-512 MHz.
The *Bearcat* 210XL scanning radio is the second generation scanner that replaces the popular *Bearcat* 210 and 211. It has almost twice the scanning capacity of the *Bearcat* 210 with 18 channels plus dual scanning speeds and a bright green fluorescent display. Automatic search finds new frequencies. Features scan delay, single antenna, patented track tuning and more!

NEW! Bearcat® 160

List price $299.95/**CE price $189.00**
16 Channels • 3 Bands • AC only • Priority Dual Scan Speeds • Direct Channel Access
Frequency range: 32-50, 144-174, 440-512 MHz.
Would you believe...the *Bearcat* 160 is the least expensive *Bearcat* crystalless scanner.

This scanner presents a new dimension in scanning form and function. Look at the smooth keyboard. No buttons to punch. No knobs to turn. Instead, finger-tip pads provide control of *all* scanning operations, including On/Off, Volume and Squelch. The *Bearcat* 160 features 16-channel monitoring of the most popular public service bands. And to locate more of what you're listening for, Electra introduces another operating convenience: Manual Search. Used with Automatic Search it simplifies seeking and finding unknown but active frequencies. Of course the *Bearcat* 160 incorporates other advanced *Bearcat* features such as Priority, Direct Channel Access, Dual Scan Speeds, Automatic Channel Lockout, Scan Delay and Auxiliary. All this performance in sleek, contemporary styling. And at a price so low, it astounds even us!

Bearcat® 5

List price $134.95/**CE price $94.00**
8 Crystal Channels • 3 Bands • AC only
Frequency range: 33-50, 146-174, 450-508 MHz.
The *Bearcat* 5 is a value-packed crystal scanner built for the scanning professional — at a price the first-time buyer can afford. Individual lockout switches.

Bearcat® Four-Six ThinScan™

List price $189.95/**CE price $124.00**
Frequency range: 33-47, 152-164, 450-508 MHz.
The incredible, new *Bearcat* Four-Six Thin Scan™ is like having an information center in your pocket. This three band, 6 channel crystal controlled scanner has patented Track Tuning on UHF. Scan Delay and Channel Lockout. Measures 2¾ x 6¼ x 1" Includes rubber ducky antenna. Order crystals for each channel. Made in Japan.

OTHER BEARCAT ACCESSORIES

SP50 AC Adapter for *Bearcat* ThinScan™ $9.00
SP51 Battery Charger for *Bearcat* ThinScan™ $9.00
SP58 Carrying Case for *Bearcat* ThinScan™ $12.00
FB-E Frequency Directory for Eastern U.S.A. $12.00
FB-W Frequency Directory for Western U.S.A. $12.00
B-4 1.2 V AAA Ni-Cad's for *Bearcat* ThinScan™ $9.00
A-135cc Crystal certificate $3.00
Add $3.00 shipping for all accessories ordered at the same time.

INCREASED PERFORMANCE ANTENNAS

If you want the utmost in performance from your *Bearcat* scanner, it is essential that you use an external antenna. We have two base and mobile antennas specifically designed for receiving all bands. Order **#A60** is a magnet mount mobile antenna and **#A70** is an all band base station antenna. Both antennas are $35.00 each and $3.00 per antenna for UPS shipping in the continental United States.

TEST ANY BEARCAT SCANNER

Test any *Bearcat* scanner purchased from **Communications Electronics™** for 31 days before you decide to keep it. If for any reason you are not completely satisfied, return it in original condition with all parts in 31 days, for a prompt refund (less shipping/handling charges).

MADE BY ELECTRA

Since all *Bearcat* scanners are products of Electra Company, a Division of Masco Corporation of Indiana, you can be assured of the finest monitor radios available in the world. With your *Bearcat* scanner, you will receive a complete set of simple operating instructions and a one-year limited warranty from Electra. If service is ever required for any *Bearcat* scanner, just send your receiver to an Electra national service center.

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7400

SN7400N	.25	SN7472N	.29	SN74156N	.79
SN7401N	.28	SN7473N	.35	SN74157N	.69
SN7402N	.25	SN7474N	.35	SN74160N	.89
SN7403N	.25	SN7475N	.49	SN74161N	.89
SN7404N	.25	SN7476N	.35	SN74162N	.89
SN7405N	.29	SN7478N	.49	SN74163N	.89
SN7406N	.35	SN7479N	5.00	SN74164N	.89
SN7407N	.35	SN7480N	.50	SN74165N	.89
SN7408N	.29	SN7482N	.99	SN74367N	2.75
SN7409N	.29	SN7483N	.89	SN74178N	1.95
SN7410N	.25	SN7484N	.89	SN74179N	4.95
SN7411N	.29	SN7485N	.89	SN74173N	1.39
SN7412N	.35	SN7486N	.35	SN74174N	.99
SN7413N	.49	SN7489N	1.75	SN74175N	.89
SN7414N	.69	SN7490N	.69	SN74176N	.79
SN7416N	.29	SN7491N	.69	SN74177N	.79
SN7417N	.29	SN7492N	.65	SN74179N	1.49
SN7420N	.25	SN7493N	.65	SN74180N	.89
SN7421N	.29	SN7494N	.69	SN74181N	2.25
SN7422N	.45	SN7495N	.69	SN74182N	.79
SN7423N	.29	SN7496N	.69	SN74184N	2.49
SN7425N	.29	SN7497N	3.00	SN74185N	2.49
SN7426N	.29	SN74100N	1.49	SN74190N	1.25
SN7427N	.25	SN74107N	.35	SN74191N	1.25
SN7428N	.39	SN74109N	.39	SN74192N	.89
SN7430N	.25	SN74116N	1.95	SN74193N	.89
SN7432N	.29	SN74121N	.35	SN74194N	.89
SN7437N	.35	SN74122N	.55	SN74195N	.69
SN7438N	.40	SN74123N	.59	SN74196N	.89
SN7439N	.25	SN74125N	.49	SN74197N	.89
SN7440N	.20	SN74132N	.75	SN74198N	1.40
SN7441N	.69	SN74136N	.75	SN74199N	1.49
SN7442N	.59	SN74141N	.99	SN74221N	1.25
SN7443N	1.10	SN74142N	3.25	SN74251N	.99
SN7444N	1.10	SN74143N	3.49	SN74276N	1.95
SN7445N	.89	SN74144N	3.49	SN74279N	.79
SN7446N	.79	SN74145N	.79	SN74283N	1.40
SN7447N	.69	SN74147N	1.95	SN74284N	3.95
SN7448N	.79	SN74148N	1.29	SN74285N	3.95
SN7450N	.20	SN74150N	1.25	SN74365N	.69
SN7451N	.20	SN74151N	.69	SN74366N	.69
SN7453N	.20	SN74152N	.69	SN74367N	.69
SN7454N	.20	SN74153N	.79	SN74368N	.69
SN7459A	.25	SN74154N	1.25	SN74390N	1.49
SN7460N	.20	SN74155N	.79	SN74393N	1.49
SN7470N	.29				

74LS00

74LS00	.29	74LS92	.75	74LS192	1.15
74LS01	.29	74LS93	.75	74LS193	1.15
74LS02	.29	74LS95	.75	74LS194	1.15
74LS03	.29	74LS107	.65	74LS195	1.15
74LS04	.35	74LS109	.65	74LS197	1.19
74LS05	.29	74LS112	.65	74LS221	1.19
74LS08	.29	74LS113	.65	74LS240	1.95
74LS09	.35	74LS114	.69	74LS241	1.95
74LS10	.29	74LS122	.89	74LS242	1.95
74LS11	.75	74LS123	.89	74LS243	1.95
74LS12	.75	74LS124	.89	74LS244	1.95
74LS13	.59	74LS132	.89	74LS245	2.95
74LS14	.99	74LS133	.59	74LS247	1.19
74LS15	.39	74LS136	.59	74LS248	1.19
74LS20	.29	74LS138	.59	74LS249	1.19
74LS21	.29	74LS139	.59	74LS251	1.49
74LS22	.35	74LS145	.89	74LS253	.99
74LS26	.35	74LS147	1.75	74LS257	.99
74LS27	.35	74LS148	1.75	74LS258	.99
74LS30	.35	74LS151	.89	74LS260	.69
74LS32	.35	74LS153	.89	74LS266	.69
74LS33	.59	74LS154	1.75	74LS273	1.95
74LS37	.49	74LS155	.89	74LS279	.75
74LS38	.49	74LS156	1.19	74LS283	1.09
74LS40	.35	74LS157	.89	74LS290	.99
74LS42	.89	74LS158	.89	74LS293	.99
74LS47	.89	74LS160	1.15	74LS298	1.25
74LS48	1.15	74LS161	1.15	74LS352	1.29
74LS49	1.15	74LS162	1.15	74LS353	1.29
74LS51	.29	74LS163	1.15	74LS366	.75
74LS54	.29	74LS169	1.25	74LS367	.75
74LS55	.29	74LS166	1.25	74LS368	.75
74LS73	.49	74LS168	1.19	74LS373	1.55
74LS74	.39	74LS170	2.49	74LS374	1.55
74LS75	.59	74LS173	1.39	74LS375	.89
74LS76	.45	74LS174	.99	74LS386	.69
74LS78	.49	74LS175	.99	74LS393	2.49
74LS83	.69	74LS181	2.95	74LS670	2.49
74LS85	1.25	74LS190	1.25	81LS95	1.95
74LS86	.65	74LS191	1.25	81LS97	1.95
74LS90	.59				

74S

74S00	.50	74S133	.55	74S244	3.25
74S02	.50	74S134	.69	74S251	1.45
74S03	.50	74S135	1.19	74S253	1.45
74S04	.55	74S136	1.75	74S257	1.35
74S05	.55	74S138	1.35	74S258	1.35
74S08	.50	74S139	1.35	74S260	.79
74S09	.50	74S140	1.15	74S280	2.95
74S10	.50	74S151	1.35	74S287*	4.95
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74S15	.50	74S157	1.35	74S373	3.49
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74S22	.50	74S174	1.59	74S387*	5.95
74S30	.50	74S175	1.59	74S471	19.95
74S32	.55	74S181	4.95	74S472*	19.95
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74S64	.50	74S195	1.95	74S478*	21.95
74S65	.50	74S196	3.95	74S570*	7.95
74S74	.79	74S240	2.95	74S571*	7.95
74S86	.79	74S241	2.95	74S572*	19.95
74S112	.79	74S242	3.25	74S573*	19.95
74S113	.79	74S243	3.25	74S940	3.15
74S114	.79			74S941	3.15

* LIMITED AVAILABILITY ON THESE PROMS

CA–LINEAR

CA3013H	2.15	CA3081N	2.00	CA3089N	3.75
CA3023H	3.25	CA3082N	2.00	CA3096N	3.95
CA3039H	1.35	CA3083N	1.60	CA3130H	1.39
CA3046N	1.30	CA3086N	.85	CA3140H	1.25
CA3059N	3.25			CA3160H	1.25
CA3060N	3.25			CA3401N	.59
CA3080H	1.25			CA3600N	3.50

CD–CMOS

CD4000	.39	CD4041	1.49	CD4082	.39
CD4001	.39	CD4042	.99	CD4093	.99
CD4002	.39	CD4043	.89	CD4098	2.49
CD4006	1.19	CD4044	.89	CD4506	.75
CD4007	.25	CD4046	1.79	CD4507	.99
CD4008	1.49	CD4047	2.50	CD4508	3.95
CD4009	.49	CD4048	1.35	CD4510	1.39
CD4010	.49	CD4049	.49	CD4511	1.29
CD4011	.39	CD4050	.49	CD4512	3.95
CD4012	.25	CD4051	1.19	CD4515	2.95
CD4013	.49	CD4052	1.19	CD4516	1.49
CD4014	1.39	CD4053	1.19	CD4518	1.79
CD4015	1.19	CD4054	.99	CD4519	.89
CD4016	.89	CD4055	1.79	CD4520	1.29
CD4017	1.19	CD4056	2.95	CD4526	1.79
CD4018	.99	CD4059	9.95	CD4528	1.79
CD4019	.49	CD4060	1.49	CD4529	1.95
CD4020	1.19	CD4066	.79	CD4543	2.79
CD4021	1.29	CD4068	.39	CD4562	11.95
CD4022	1.19	CD4069	.45	CD4583	2.79
CD4023	.29	CD4070	.55	CD4723	1.95
CD4024	.79	CD4071	.49	CD4724	1.95
CD4025	.23	CD4072	.49	MC14409	14.95
CD4026	2.95	CD4073	.39	MC14410	14.95
CD4027	.69	CD4075	.39	MC14411	14.95
CD4028	.89	CD4076	1.39	MC14412	11.95
CD4029	1.49	CD4081	.39	MC14419	4.95
CD4030	.49			MC14433	13.95
CD4035	.99				
CD4040	1.49				

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LIMITED OFFER!! — WHILE THEY LAST!!

DL-4500, DL-4507, DL-4529A, DL-4129A, DL-2300, DLG-2535, DL-4508, DL-6508, DL-6530, DL-3130

MULTI DIGIT REFLECTOR ARRAYS FOR CLOCKS

PART NUMBER	CHAR. HT. (IN.)	POLARITY	DESCRIPTION	LIGHT OUTPUT (mcd) TYP	MIN	Black	FORWARD VOLTAGE SEGMENT (V) Ip = 20mA TYP	MAX	CONTINUOUS FORWARD CURRENT PER SEGMENT (mA) MAX	PRICE
DL-4500 (Red) DL-4507 (Red)	.50	C.C. MPX	4 Digit 7 Segment With Colon And Auxiliary Indicators	6	3	10	1.7	2.2	35	2.49
DLG-4507 (amp) DLG-4507 (grn) DL-4529A (red)	.50	C.C. non-MPX		6	5	10	1.7	2.2	35	4.95
DL-4129A (red)	1.0	C.C. non-MPX		15	9		3.4	4.0		4.95
										2.49
										4.99

MULTI DIGIT REFLECTOR ARRAYS

DL-2300 (Red)	.30	C.C. MPX	7 Seg, 2 Digit D.P. Right	2.5	1.1	20	1.7	2.0	30	.99
DLG-2535 (green)	.50	C.A. MPX	8 Seg, 2 Digit		2.5	20		3.5	25	1.49
DL-4508 (Red)	.50	C.C. MPX	8 Seg, 4 Digit D.P. Right	6	3	10	1.7	2.0	30	2.49
DL-6500 (Red)	.50	C.C. MPX	7 Seg, 6 Digit D.P. Right	6	5	10	1.7	2.0	30	2.95
DL-6530 (Red)	.50	C.A. MPX	7 Seg, 6 Digit D.P. Right	8	5	10	1.7	2.0	30	2.95
DL-3130 (Red)	1.0	C.A. MPX	7 Seg, 2 Digit D.P. Right	15	10	10	3.4	4.0	30	3.99

DISCRETE LEDS

XC556R	.200"	red	5/$1	MV50	.085"	red	6/$1
XC556G	.200"	green	4/$1	XC209R	.125"	red	5/$1
XC556Y	.200"	yellow	4/$1	XC209G	.125"	green	4/$1
XC556C	.200"	clear	4/$1	XC209Y	.125"	yellow	4/$1
XC22R	.200"	red	5/$1	XC526R	.185"	red	5/$1
XC22G	.200"	green	4/$1	XC526G	.185"	green	4/$1
XC22Y	.200"	yellow	4/$1	XC526Y	.185"	yellow	4/$1
MV10B	.170"	red	4/$1	XC526C	.185"	clear	4/$1

XC111R	.190"	red	5/$1
XC111G	.190"	green	4/$1
XC111Y	.190"	yellow	4/$1
XC111C	.190"	clear	4/$1

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XC199 RED LED, METAL MTG. HDW. 2-3" LEADS.

DISPLAY LEDS

C.A. — Common Anode

Type	Polarity	Ht	Price
MAN 1	C.A.–red	.270	2.95
MAN 2	5x7 D.M.–red	.300	4.95
MAN 3	C.C.–red	.125	.25
MAN 52	C.A.–green	.300	1.25
MAN 54	C.C.–green	.300	1.25
MAN 71	C.A.–red	.300	.75
MAN 72	C.A.–red	.300	.75
MAN 74	C.C.–red	.300	1.25
MAN 82	C.A.–yellow	.300	.69
MAN 84	C.C.–yellow	.300	.99
MAN 3620	C.A.–orange	.300	.69
MAN 3630	C.A.–orange ± 1	.300	.99
MAN 3640	C.C.–orange	.300	.99
MAN 4610	C.A.–orange	.400	.99
MAN 6610	C.A.–orange–DD	.560	.99
MAN 6630	C.A.–orange ± 1	.560	.99
MAN 6640	C.C.–orange–DD	.560	.99
MAN 6660	C.C.–orange ± 1	.560	.99
MAN 6660	C.A.–orange	.560	.99
MAN 6710	C.A.–red–DD	.560	.99
MAN 6750	C.C.–red ± 1	.560	.99
MAN 6780	C.C.–red	.560	.99
DLO304	C.C.–orange	.300	1.25
DLO307	C.A.–orange	.300	1.25
DLO560	C.C.–green	.500	1.25

C.C. — Common Cathode

Type	Polarity	Ht	Price
DLG507	C.A.–green	.500	1.25
DL704	C.C.–red	.300	1.25
DL707	C.A.–red	.300	1.25
DL728	C.C.–red	.560	1.49
DL741	C.A.–red	.660	1.25
DL746	C.A.–red ± 1	.630	1.49
DL747	C.A.–red	.660	1.49
DLO850	C.C.–orange	.800	1.49
DL338	C.C.–red	.110	.35
FND358	C.C. ± 1	.357	.99
FND359	C.C.	.357	.75
FND503	C.C. (FND580)	.500	.99
FND507	C.A. (FND530)	.500	.99
HDSP-3401	C.A.–red	.300	1.50
HDSP-3403	C.C.–red	.300	1.50
5082-7751	C.A.,R.H.D.–red	.430	1.25
5082-7760	C.C.,R.H.D.–red	.430	1.75
5082-7300	4x7 sgl. dig. RHD	.680	22.00
5082-7302	4x7 sgl. dig. LHD	.680	22.00
5082-7304	Overnge. char. (±1)	.600	19.95
HP438	Photo Xsistor Opto-Isol.	.99	
LIT-1	Photo Xsistor Opto-Isol.	.69	
MOC3010	Optically Isol.Triac Driver	1.25	

POTENTIOMETERS

$2.95 each
2 Watt @ 70°C ± 10%
7/8" Slotted Shaft
Linear Taper
Meets Mil-R-94

Part No.		
CMU 1021	RV4NAY SD - 102A	1K
CMU 5021	RV4NAY SD - 502A	5K
CMU 1031	RV4NAY SD - 103A	10K
CMU 2531	RV4NAY SD - 253A	25K
CMU 5031	RV4NAY SD - 503A	50K
CMU 1041	RV4NAY SD - 104A	100K
CMU 1052	RV4NAY SD - 105A	1Meg

$1.35 each
3/4 Watt @ 70°C
15 turn pot. Linear taper. Printed circuit mount.

Part No.		
830P- 500hm	830P- 5K	830P-100K
830P-1000ohm	830P-10K	830P-200K
830P-2500ohm	830P-20K	830P-500K
830P-1K	830P-50K	830P-1Meg
830P-2K		

LOW PROFILE (TIN) SOCKETS

	1-24	25-49	50-100
8 pin LP	.17	.16	.15
14 pin LP	.20	.19	.18
16 pin LP	.22	.21	.20
18 pin LP	.29	.28	.27
20 pin LP	.34	.32	.30
22 pin LP	.37	.36	.35
24 pin LP	.38	.37	.36
28 pin LP	.45	.44	.43
36 pin LP	.60	.59	.58
40 pin LP	.63	.62	.61

SOLDERTAIL (GOLD) STANDARD

	1-24	25-49	50-100
8 pin SG	.39	.35	.31
14 pin SG	.49	.45	.41
16 pin SG	.54	.49	.44
18 pin SG	.59	.53	.48
24 pin SG	.79	.75	.69
28 pin SG	1.10	1.00	.90
36 pin SG	1.65	1.40	1.25
40 pin SG	1.75	1.59	1.45

SOLDERTAIL STANDARD (TIN)

	1-24	25-49	50-100
14 pin ST	.27	.25	.24
16 pin ST	.30	.27	.25
18 pin ST	.35	.32	.30
24 pin ST	.49	.45	.42
28 pin ST	.99	.90	.81
36 pin ST	1.30	1.26	1.15
40 pin ST	1.59	1.45	1.30

WIRE WRAP SOCKETS (GOLD) LEVEL #3

	1-24	25-49	50-100
8 pin WW	.59	.54	.49
10 pin WW	.69	.63	.58
14 pin WW	.79	.73	.67
16 pin WW	.85	.77	.70
18 pin WW	.99	.90	.81
20 pin WW	1.19	1.08	.99
22 pin WW	1.49	1.35	1.23
24 pin WW	1.39	1.25	1.14
28 pin WW	1.69	1.53	1.38
36 pin WW	2.19	1.99	1.79
40 pin WW	2.29	2.09	1.89

1/4 WATT RESISTOR ASSORTMENTS – 5%

ASST. 1	5ea.	10 Ohm 27 Ohm	12 Ohm 33 Ohm	15 Ohm 39 Ohm	18 Ohm 47 Ohm	22 Ohm 56 Ohm		50pcs.	$1.95
ASST. 2	5ea.	68 Ohm 180 Ohm	82 Ohm 220 Ohm	100 Ohm 270 Ohm	120 Ohm 330 Ohm	150 Ohm 390 Ohm		50pcs.	$1.95
ASST. 3	5ea.	470 Ohm 1.2K	560 Ohm 1.5K	680 Ohm 1.8K	820 Ohm 2.2K	1K 2.7K		50pcs.	$1.95
ASST. 4	5ea.	3.3K 8.2K	3.9K 10K	4.7K 12K	5.6K 15K	6.8K 18K		50pcs.	$1.95
ASST. 5	5ea.	22K 56K	27K 68K	33K 82K	39K 100K	47K 120K		50pcs.	$1.95
ASST. 6	5ea.	150K 390K	180K 470K	220K 560K	270K 680K	330K 820K		50pcs.	$1.95
ASST. 7	5ea.	1M 2.7M	1.2M 3.3M	1.5M 3.9M	1.8M 4.7M	2.2M 5.6M		50pcs.	$1.95
ASST. 8R		Includes Resistor Assts. 1-7 (350 pcs.)							$10.95 ea.

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7045IPI	CMOS Precision Timer	14.95
7045EV/Kit*	Stopwatch Chip, XTL	22.95
7106CPL	3½ Digit A/D (LCD Drive)	16.95
7106EV/Kit*	IC, Circuit Board, Display	34.95
7107CPL	3½ Digit A/D (LED Drive)	16.95
7107EV/Kit*	IC, Circuit Board, Display	28.95
7136CPL	3½ Digit A/D LCD Dis. HLD.	16.95
7117CPL	3½ Digit A/D LED Dis. HLD.	17.95
7201IDR	Low Battery Volt Indicator	2.25
7205IPG	CMOS LED Stopwatch/Timer	12.95
7208EV/Kit*	Stopwatch Chip, XTL	10.95
7208CJPE	Tone Generator	5.15
7208CEV/Kit*	Tone Generator Chip, XTL	9.95
7201AIPD	Oscillator Controller	6.50
7207AEV/Kit*	Freq. Counter Chip, XTL	11.50
7208IPI	Seven Decade Counter	17.95
7209IPA	Clock Generator	2.95
7215IPG	4 Func. CMOS Stopwatch CKT	13.95
7215EV/Kit*	4 Func. Stopwatch Chip, XTL	19.95
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100 pf	.08	.06	.05	.022µF	.09	.07	.06
220 pf	.08	.06	.05	.047µF	.09	.07	.06
470 pf	.08	.06	.05	.1µF	.15	.12	.10

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.33/35V	.39	.34	.29	4.7/35V	.83	.74	.59
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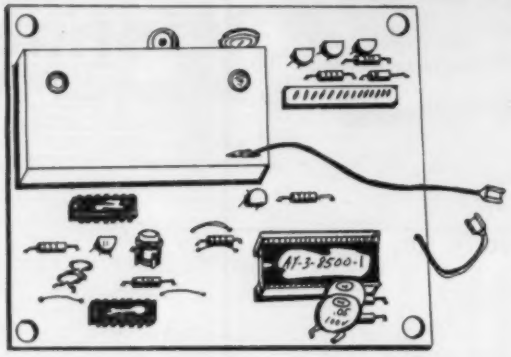
3.3/50V	.17	.15	.11	1.0/16V	.15	.14	.13
4.7/25V	.17	.15	.11	1.0/25V	.16	.15	.14
10/25V	.18	.15	.11	1.0/50V	.17	.15	.14
10/50V	.19	.16	.12	3.3/16V	.15	.14	.13
22/25V	.19	.16	.12	4.7/25V	.17	.16	.14
22/50V	.24	.20	.16	4.7/50V	.17	.15	.14
47/25V	.25	.23	.21	10/16V	.15



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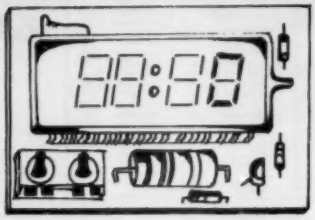

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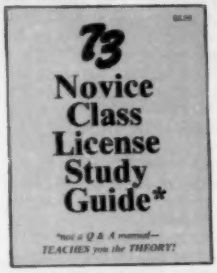

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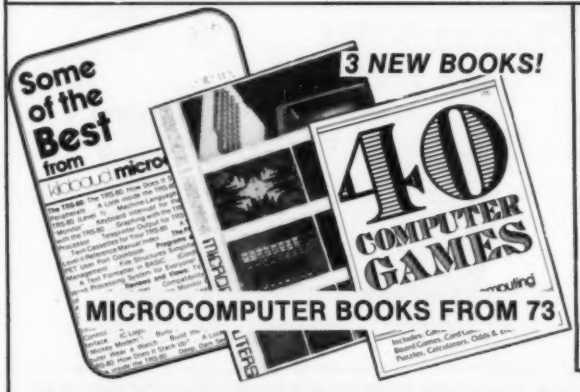

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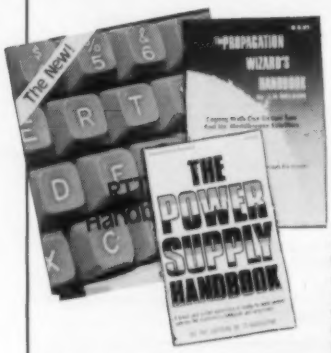

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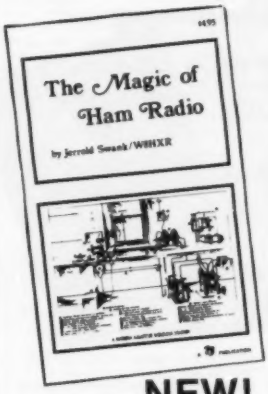

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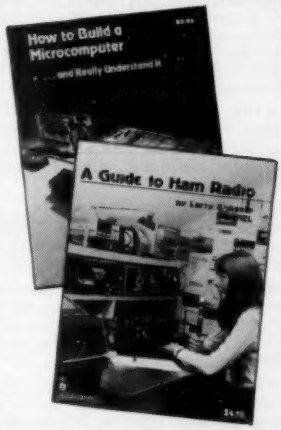

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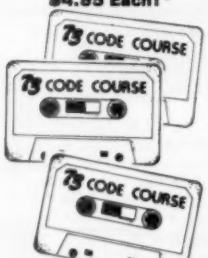

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A = Next higher frequency may also be useful
B = Difficult circuit this period
F = Fair G = Good P = Poor
SF = Chance of solar flares

march

sun	mon	tue	wed	thu	fri	sat
1 F	2 F	3 F	4 G	5 G	6 G	7 G
8 G	9 G	10 G	11 G	12 G	13 F	14 F
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5. ☐ 41-60
6. ☐ Over 60

II. Are you living on a fixed, or retirement, income?
A. ☐ Yes
B. ☐ No

III. How long have you been a ham?
1. ☐ Less than one year
2. ☐ 1-5 years
3. ☐ 6-10 years
4. ☐ 11-25 years
5. ☐ Over 25 years

IV. What class license do you hold?
A. ☐ Novice
B. ☐ Technician
C. ☐ General
D. ☐ Advanced
E. ☐ Amateur Extra
F. ☐ Not licensed

V. Are you an ARRL member?
1. ☐ Yes
2. ☐ No

VI. If yes to question 5, please indicate membership.
A. ☐ Regular
B. ☐ Life

VII. How much time do you spend hamming?
1. ☐ Less than 10 hours per week
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VIII. Is Amateur Radio your only hobby?
A. ☐ Yes
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IX. Please list your other major interests.
1. ☐ Computers
2. ☐ Flying
3. ☐ Photography
4. ☐ Outdoor sports

X. Do you belong to an Amateur Radio Club?
A. ☐ Yes
B. ☐ No

XI. If yes to above, does your club have a Novice or newcomers class?
1. ☐ Yes
2. ☐ No

XII. Do you plan to build any equipment during the next year?
A. ☐ Yes
B. ☐ No

XIII. Did you build any equipment during the past year?
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2. ☐ No

XIV. Do you own a microcomputer?
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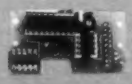

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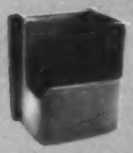

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